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In Memoriam:

Theodore Roosevelt

In the death of Theodore Roosevelt the Society of American Foresters mourns the loss of its greatest, most brilliant, and most effective leader. The early growth of the profession of forestry in the United States was intimately bound up with his statesmanship while President. As a leader of the conservation movement, he brought forcibly home to the American people the need of wise use and protection of the natural resources of this country. The crystallization of the conservation policy and the realization in large measure of forest conservation was one of the greatest achievements of his administration, and of profound significance in our progress toward national efficiency.

As a lover of nature and the out-of-doors, he was keenly interested in the forests, mountains, streams, and wild life. As a traveler and explorer he expanded our knowledge of the forests of remote regions, both in Africa and in South America. By his proclamation, 148,000,000 acres of National Forests were set aside—an amount three times the total proclaimed by all other Presidents since 1891, when the making of National Forest reservations began. It was in his administration, and largely because of his advocacy, that a true National Forest policy was made possible by the transfer of the National Forests from the Department of the Interior to the Department of Agriculture, in order that these Forests might be placed under technical supervision. He realized the need of technical foresters in this country for the realization of this National Forest policy, and therefore actively furthered forest education. He became an honorary member of the Society of American Foresters, and, while President of the United States, addressed the Society upon the ideals and duties of American foresters. This address still remains to its members an inspiration of high purpose and of public service. As long as these ideals remain the guiding principle of the profession, the Society will remain in the forefront of progressive thought and action in this country.

On behalf of the Executive Committee:

Gifford Pinchot.
Henry S. Graves.

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MAHOGANY AND SOME OF ITS SUBSTITUTES

A Descriptive Key Based on the Gross and Lens Characters

By Samuel J. Record

Professor of Forest Products, Yale University

This key embraces most of the woods known to the trade as "mahogany" or used as a substitute for the wood to which the name rightly belongs. A few of importance, particularly of African origin, have been omitted because authentic material was not available to the author. Some others have been excluded because of their insignificance. Representatives of 13 families and 27 genera are described; 11 genera belong to the mahogany family Meliaceæ. The only equipment necessary to use the key is a very sharp pocket knife and a small hand lens magnifying from 10 to 15 times. Care should be taken that the cuts made, especially on cross section, be very smooth, otherwise the structure will be obscured. The two main divisions of the key are based upon the visibility or invisibility of the rays. When doubt exists on this point, as is likely where the rays are very near the limit of vision, the user may need to try both divisions. In three such cases the descriptions are duplicated. This key was prepared in connection with a course in tropical woods. Material assistance was rendered the author by his students, especially Mr. Allen B. Engle and Mr. I. Laurance Lee.

Contribution from Yale School of Forestry, No. 2.

A Rays visible on cross section without lens, though often very fine.

a Resin ducts present, usually appearing under lens (on cross section) as small white dots in few to many tangential lines which are sometimes concentric and rather widely spaced as though limiting growth rings. Pores readily visible; often subdivided; gum deposits absent; tyloses present or absent; white substance sometimes present in dense specimens. Wood parenchyma associated with resin ducts and sometimes in wavy tangential lines in certain species; not prominent on longitudinal surface. Rays conspicuous on radial surface, usually considerably darker than the fibers. Ripple-marks absent. Woods odorless. Color variable from yellowish or pinkish to reddish-brown or deep brownish-red. Density and texture widely variable. "Philippine Mahogany," "South Pacific Mahogany," Lauans, Tanguile, Bataan.

a^1 Woods comparatively heavy, hard and fine-textured. Tanguile, Bataan: *Shorea polysperma*, et al. (Dipterocarpaceæ).

b^1 Woods light, soft and coarse-textured.

a^2 Color reddish or pinkish. Red Lauan: *S. negrosensis.*

b^2 Color yellowish, grayish or nearly white. Almon, White Lauan: *S. eximia, Pentacme* spp. (Dipterocarpaceæ).

b Resin ducts absent; as a result of injury, gum ducts with dark-red contents may appear in a compact tangential row in certain species.

a[1] Woods with yellow color predominating; in some cases becoming brown upon exposure to sunlight. Gum ducts not known to occur.

a[2] Growth rings fairly distinct, due mostly to differences in density but often accompanied by a fine limiting line of wood parenchyma; no lines of parenchyma within growth rings. Pores very numerous, small to minute, more or less clustered and often in short, irregular, diagonal chains; tyloses abundant; gum and white deposits absent. Rays of the same color as the fibers; sometimes storied producing fairly distinct ripple-marks (about 100 per inch); rays not conspicuous on radial section. Wood rather light but fairly hard. Color pale yellow or yellowish-brown. PRIMA VERA, "WHITE MAHOGANY": *Tabebuia donnollesmitii* (Bignoniaceæ).

b[2] Growth rings absent or indistinct; density uniform. Pores of fairly uniform size, rather numerous; sometimes subdivided radially but not arranged diagonally; usually surrounded by parenchyma. Ripple-marks absent. Color bright yellow at first, turning brown upon exposure.

a[3] Pores rather large and prominent, surrounded by irregular patches of parenchyma sometimes confluent for a short distance or even forming long tangential lines, prominent on all sections; white deposits common; tyloses not abundant. Rays of about the same color as the fibers in fresh wood; otherwise lighter. Wood rather hard. JACKWOOD: *Artocarpus integrifolia* (Urticaceæ).

b[3] Pores medium-sized or rather small, usually associated with parenchyma which may form short inconspicuous wings not confluent into long lines; white deposits absent; tyloses abundant, appearing more or less gummy and making the vessel lines very conspicuous. Rays considerably darker than wood fibers. Color somewhat variegated or striped. Wood light and soft; rather wooly-textured. ESPAVE, "ESPAVE MAHOGANY": *Anacardium rhinocarpus* (Anacardiaceæ).

b[1] Woods with reddish, pinkish or purplish color predominating. Gum ducts known to occur in several species.

a[2] Woods with aromatic scent like cigar-box cedar.

a[3] Growth rings present. Wood parenchyma mostly in concentric lines at limits of growth rings only.

a[4] Woods mostly ring-porous or showing tendency to become so; when strictly diffuse-porous (as in certain neotropical species or varieties of *Cedrela*) growth rings are marked by conspicuous light-colored line of parenchyma showing plainly on all sections. Pores large to minute; mostly open; often subdivided; gum deposits present; white substance not observed; vessel lines usually very prominent. Gum ducts occasionally present in prominent dark-red streaks. Rays fine but distinct on all sections.

Ripple-marks absent or rarely of local occurrence. Woods variable from light, soft and spongy to fairly heavy and firm; texture fine to very coarse. Color variable, brick-red, brownish-red, light brown with pinkish hue, etc. SPANISH CEDAR, CIGAR-BOX CEDAR, CEDRO: *Cedrela odorata, C. fissilis,* et al. (Meliaceæ); TOON, RED CEDAR: *C. toona;* CALANTAS: *Toona* spp. (Meliaceæ); MARGOSA, NEEM: *Melia indica;* BEAD-TREE, PERSIAN LILAC, AUSTRALIAN WHITE CEDAR: *M. composita.*

b^4 Wood strictly diffuse-porous. Lines of wood parenchyma very fine and inconspicuous. Pores small, uniform, open; mostly subdivided; occasionally in diagonal arrangement; gum deposits present; white substance not observed; vessel lines not very prominent. Gum ducts not known to occur. Rays very fine, scarcely distinct on cross section, readily visible on radial and tangential. Ripple-marks of local occurrence. Wood rather hard; fine-textured. Color reddish-brown with golden luster. CHITTAGONG WOOD, "EAST INDIAN MAHOGANY," INDIAN REDWOOD, CEDAR, BASTARD CEDAR: *Chickrassia (Chukrasia) tabularis* (Meliaceæ).

b^3 Growth rings absent. Wood parenchyma in numerous, fine but distinct, closely and uniformly spaced concentric lines, producing distinct but not conspicuous striping on longitudinal surface. Pores medium to small; open; often subdivided; gum deposits present; white substance not observed. Vessel lines dark-red and prominent. Gum ducts not known to occur. Rays extremely fine, inconspicuous on all sections; not always visible on cross and tangential. Ripple-marks absent. Wood moderately hard. Color rose-red or bright reddish-brown. AUSTRALIAN ROSEWOOD, "AUSTRALIAN MAHOGANY": *Dysoxylon fraseranum* (Meliaceæ).

b^2 Woods without aromatic scent. Always diffuse-porous.

a^3 Wood parenchyma in tangential or concentric lines. Growth rings present; limited by parenchyma and sometimes marked by differences in density.

a^4 Pores usually indistinct without lens; not surrounded by parenchyma; solitary or subdivided; open; gum deposits and white substance absent. Wood parenchyma in fine concentric lines at limits of growth rings which are usually distinct on longitudinal surface. Rays distinct on radial surface, indistinct on tangential; sometimes not visible on cross section without lens. Ripple-marks absent. Wood of very fine and uniform texture; usually straight-grained. Hard and heavy but readily worked. Odorless. Color brown tinged with red; sometimes decidedly reddish. BIRCH: *Betula lenta, B. lutea* (Betulaceæ).

b^4 Pores distinct without lens.

a^5 Lines of wood parenchyma conspicuous on all sections; usually light-colored but sometimes reddish; concentric and apparently limiting growth rings; sometimes rather closely spaced. Rays on radial surface distinct but not decidedly darker than fibers; occasional exceptions. Ripple-marks often present throughout (about 50 per inch); distinct. Gum ducts not uncommon, producing prominent dark-red streaks. White deposits common in vessels of dense wood. Wood variable from light and soft to hard and heavy. Color variable from maroon to reddish or pinkish brown; occasionally yellowish. TRUE MAHOGANY, CAOBA, BAYWOOD: *Swietenia mahagoni*, *S. macrophyllum* (Meliaceæ).

b^5 Lines of wood parenchyma visible without lens but not prominent on any section; mostly dark reddish. Rays very fine and not always distinct on cross section; prominent on radial surface and darker than fibers. Woods moderately dense; fairly uniform. Color red-brown or chocolate.

a^6 Interior of growth rings marked with numerous wavy or broken tangential lines of parenchyma. Rays showing plainly on tangential surface as short uniform lines less than .03 inch long; more or less storied, producing ripple-marks (about 50 per inch), at least locally. Gum ducts not known to occur. SAPELI, "AFRICAN MAHOGANY": *Entandrophragma candolei* (Meliaceæ).

b^6 Interior of growth rings normally without parenchyma lines. Rays showing rather indistinctly on tangential surface as lines of varying length, many of them .06 inch or more; not storied. No ripple-marks. "DEMERARA MAHOGANY," CRABWOOD, CARAPA, ANDIROBA: *Carapa guianensis*, et al. (Meliaceæ); "AFRICAN MAHOGANY": *C. gogo*.

b^3 Wood parenchyma not in tangential or concentric lines. Growth rings, if present, due to differences in density of wood.

a^4 Rays on tangential surface showing conspicuously as narrow lines of varying length, many of them from .06 to .10 inch long; never storied; very dark and prominent on radial surface. Ripple-marks present (about 60 per inch) due to storied arrangement of vessel segments and wood fibers. Vessel segments uniform in length and visible without lens; apparently lined with reddish gum and sometimes filled with it. Rows of gum ducts occasionally present and very conspicuous. Wood light and soft but firm; rather coarse-textured. Color reddish-brown with

a golden luster. LUMBAYAO, "LUMBAYAO MAHOGANY," "PHILIPPINE MAHOGANY": *Tarrietia javanica* (Sterculiaceæ).

b^4 Rays on tangential surface inconspicuous; all less than .05 inch; not storied except sometimes locally. Vessel segments of irregular length and indistinct.

a^5 Gum present in vessels; localized often as dark specks on surface of wood. Rays fine but readily visible on tangential section; sometimes more or less storied locally producing irregular ripple-marks (about 50 per inch). Rows of gum ducts occasionally present. Wood variable from light and soft to rather hard and heavy. Color light to dark reddish-brown, sometimes with purplish tinge. "AFRICAN MAHOGANY," "GAMBIA MAHOGANY": *Khaya senegalensis*, et al. (Meliaceæ).

b^5 No gum deposits in vessels. Rays extremely fine, barely visible on tangential section; not storied. No ripple-marks. Gum ducts not known to occur. Wood light and soft but firm. Color light pinkish- or purplish-brown. "LIBREVILLE MAHOGANY," OKUMÉ, GABOON, CEDAR: *Boswellia klaineana* (Burseraceæ).

B Rays not visible on cross section without lens.

a Wood parenchyma visible, usually without lens; indistinct to very distinct. Gum ducts not known to occur.

a^1 Wood parenchyma in numerous closely spaced tangential or concentric lines.

a^2 Wood parenchyma of same color as or darker than fibers; in concentric lines, mostly independent of the pores; appearing on longitudinal surface as wavy red lines. Pores readily visible; mostly open. Ripple-marks absent. Growth rings apparently absent.

a^3 Many of the pores subdivided radially; little or no tendency to diagonal grouping; tyloses absent; white substance sometimes present. Lines of wood parenchyma often as broad as the pores; not conspicuous on any section. Wood rather hard. Color brick-red or maroon. CANCHARANA, "BASTARD MAHOGANY": *Cabralea* spp. (Meliaceæ).

b^3 Few pores subdivided radially; arranged in groups or diagonal rows; tyloses present; white substance not observed. Lines of wood parenchyma about one-half as wide as the pores; conspicuous on longitudinal surface as fine zig-zag lines. Wood soft to rather hard. Color brownish-red or purplish. "BORNEO MAHOGANY," PALO MARIA, POON: *Calophyllum inophyllum* (Guttiferæ); SANTA MARIA, OCUJE, "CHIJOLE MAHOGANY": *C. calaba; JACARIUBA*: *C. Braziliense*.

b^2 Wood parenchyma of lighter color than fibers.

a^3 Ripple-marks distinct under lens (over 100 per inch). Pores of irregular size and distribution, tending to make wood ring-

porous. Wood parenchyma in fine but distinct lines of irregular width, length and distribution; extending wing-like from pores, connecting pores or becoming continuous and concentric; often wavy; more or less conspicuous on longitudinal surface. Woods moderately to very dense. Faint cedary scent sometimes present in certain species. Color widely variable; dark-red or crimson, dull red, reddish-brown or brown, often variegated; red color fading upon exposure. "TENASSERIM MAHOGANY," VERMILION, ANDAMAN REDWOOD, PADOUK: *Pterocarpus dalbergioides* (Leguminosæ); PADOUK, BURMESE ROSEWOOD, "INDIAN MAHOGANY," "PHILIPPINE MAHOGANY," NARRA: *P. indicus*.

b^3 Ripple-marks absent. Woods never ring-porous. Wood parenchyma in fine or very fine lines, mostly independent of the pores.

a^4 Woods fragrantly scented. Wood parenchyma in fine but distinct, closely and uniformly spaced, concentric lines, producing fine striping on longitudinal surface. Growth rings absent. Pores solitary or subdivided radially; gum deposits present; tyloses absent or few. Rays not prominent on radial surface. Woods moderately hard.

a^5 Pores of medium size; very distinct; vessel lines very prominent on longitudinal surface; white deposits not observed. Texture medium. Color bright reddish-brown. AUSTRALIAN ROSEWOOD, "AUSTRALIAN MAHOGANY": *Dysoxylon fraseranum* (Meliaceæ).

b^5 Pores small, not very distinct; vessel lines not prominent; white deposits occasionally found. Texture fine. Color dull brick-red. AUSTRALIAN ROSEWOOD, "SCRUB MAHOGANY": *Synoum glandulosum* (Meliaceæ).

b^4 Woods not scented. Wood parenchyma inconspicuous on longitudinal surface. Vessels without gum and white deposits; tyloses present.

a^5 Pores in radial or diagonal rows; individual pores scarcely distinct without lens; tyloses often abundant; vessel lines inconspicuous. Rays not prominent on radial surface. Growth rings absent. Wood parenchyma mostly in very fine broken or wavy tangential lines. Wood very dense and fine-textured. Color deep reddish- or purplish-brown; uniform. BALATA, BULLETWOOD, MASSARANDUBA: *Mimusops globosa*, et al. (Sapotaceæ).

b^5 Pores scattered; solitary or doubled; individually distinct without lens; tyloses present but not abundant; vessel lines conspicuous. Growth rings present but not always clearly defined. Rays prominent on radial

surface. Wood parenchyma in numerous fine but distinct concentric lines. Wood rather dense; medium-textured. Color rather light reddish brown with purplish tinge; often striped. "COLOMBIAN MAHOGANY," ALBARCO: *Cariniana pyriformis* (Lethycidaceæ).

b^1 Wood parenchyma not in very numerous closely spaced tangential or concentric lines; concentric lines, if present, are always or mostly at limits of growth rings.

a^2 Pores and pore-groups surrounded by a circle or patch of parenchyma of lighter color than the fibers. Vessel lines conspicuous.

a^3 Pores rather large with narrow circles of parenchyma which are not confluent; mostly solitary but occasionally subdivided; irregularly disposed with tendency to become ring-porous; sometimes in diagonal chains; mostly open; reddish gum present; white substance not observed. Fine concentric lines of parenchyma at limits of growth rings. Rays inconspicuous on radial surface; scarcely visible on tangential even with lens; sometimes faintly visible on cross section without lens. Ripple-marks absent. Wood hard and heavy but easily worked. Odorless. Color chestnut brown tinged with red; sometimes striped. SABICU: *Lysiloma sabicu* (Leguminosæ).

b^3 Pores small to minute within prominent patches of parenchyma which are sometimes confluent; solitary or more often subdivided; well distributed, without tendency to become ring-porous; sometimes in diagonal chains; mostly open; reddish gum present; white substance not observed. Growth rings present but not limited by parenchyma except locally. Rays inconspicuous on radial surface; scarcely visible on tangential even with lens. Ripple-marks irregular; about 80 per inch. Wood very dense. Odorless. Color dark purplish brown with light-colored vessel lines; sapwood yellowish white with reddish streaks. TAMARIND, MADEIRA, "MADEIRA MAHOGANY": *Tamarindus indica* (Leguminosæ).

b^2 Pores and pore groups not surrounded by parenchyma. Vessel lines visible but not conspicuous.

a^3 Pores usually indistinct without lens; numerous and well distributed; solitary or subdivided; open; gum deposits and white substance absent. Wood parenchyma in fine concentric lines at limits of growth rings which are usually distinct on longitudinal surface. Rays distinct on radial surface, indistinct on tangential; often visible on cross section without lens. Ripple-marks absent. Wood hard, of very fine and uniform texture; usually straight-grained. Odorless. Color brown tinged with red or pink; sometimes decidedly reddish. BIRCH: *Betula lenta, B. lutea* (Betulaceæ).

b^3 Pores small but distinct without lens; numerous and well-distributed; solitary or mostly subdivided; mostly open; gum deposits present; white substance not observed. Wood paren-

chyma in fine concentric lines at limits of growth rings which are not always distinct on longitudinal surface. Rays readily visible on radial and tangential surfaces. Ripple-marks of local occurrence. Wood rather hard; fine-textured; usually ribbon-grained. Fragrantly scented. Color reddish-brown with golden luster. CHITTAGONG WOOD, "EAST INDIAN MAHOGANY," INDIAN REDWOOD, CEDAR, BASTARD CEDAR: *Chickrassia* (*Chukrasia*) *tabularis* (Meliaceæ).

b Wood parenchyma not visible. Growth rings present. Ripple-marks absent. Rays inconspicuous on radial section; scarcely visible on tangential even with lens.

a^1 Pores very small, open; occasionally in oblique or even zig-zag rows. Gum ducts not known to occur. Wood hard, heavy, fine-textured, uniform.

a^2 Wood light-colored, grayish or brownish. BRUSH BOX, "BRISBANE MAHOGANY": *Tristania conferta* (Myrtaceæ).

b^2 Wood dark-colored, reddish. "SWAMP MAHOGANY," WATER GUM: *T. laurina*.

b^1 Pores rather small, filled with tyloses; often in diagonal rows. Large gum ducts sometimes present. Wood extremely hard and heavy, medium-textured, with interlaced grain.

a^2 Wood oily or greasy. TALLOWWOOD, "RED MAHOGANY": *Eucalyptus microcorys* (Myrtaceæ).

b^2 Wood not oily or greasy.

a^3 Color pale-brown or very light. "WHITE MAHOGANY": *E. acmenoides*, *E. robusta*.

b^3 Color deep red. "RED MAHOGANY": *E. resinifera*.

SOME BIOLOGICAL AND ECONOMIC ASPECTS OF THE CHAPARRAL

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The field for study that is open in the chaparral forests of the Southwest is unlimited and their importance from many standpoints is as yet but little realized. There are a number of phases of the work carried on in these brush forests that are of interest, a few of which are treated here.

Two types of chaparral have been recognized, one temporary and the other permanent. This distinction has been based on a fallacious empiricism that the temporary chaparral was the result of a fire, or repeated fires, which destroyed tree growth and made conditions unfavorable for the return of the forest, while permanent chaparral occupied areas where tree growth was impossible or where it was unable to encroach upon the chaparral because of the aggressiveness of the brush; in other words, the forest was being crowded out by the chaparral and would in time disappear. As a matter of fact, the so-called "true or permanent" chaparral is also a temporary type, but because of the more severe conditions under which it grows the rotation is much longer. A number of factors support this point of view, some of which are: the dominant species of chaparral of the temporary type in northern California are also found as dominant species in southern California; scattered trees and tree stands exist in the chaparral where fires as yet have been unable to entirely destroy the growth due to the strength of the species; good reproduction of coniferous forest trees exist in localities wherever the chaparral is supposed to be driving out the forest; successful plantations have been made in the chaparral at elevations from 1,500 feet up on all slopes and in brush of varying degrees of density.

The application of the plant-indicator idea to the sand-hill region of Kansas and Nebraska has resulted in the successful planting of various conifers in this region which held no promise of success, and similar plant indicators are found in this region which indicate similar sites. Thus, in northern California, *Ceanothus* indicates a site for yellow pine, in southern California one for Jeffrey pine; *Cercocarpus*

in the north indicates a Douglas fir site, in southern California a site for the sister tree, the big cone spruce; an oak in the north indicates the yellow pine-sugar pine association, in the south the same species a site for the Coulter pine.

Fire is recognized by all who have gone into the question as the agency responsible for the change in northern California from timber to brush, but it has not been so recognized in the South, where, because of greater drought, the fires have been much more severe. Chaparral forest fires are exceedingly destructive to any forest trees which may be in the stand because of the greater inflammability of the brush and the height to which the flames reach, trees whose tops were more than 50 feet above the level of the brush cover being killed. Examinations of fire areas where trees have been killed show that only 6 per cent of trees 12 inches or over escape a chaparral fire, while 20 per cent of the trees under 10 inches diameter escape the ordinary light ground fire in a forested area. What happens to these small trees during a chaparral fire needs no comment. There is scarcely a watershed on the Angeles and Cleveland Forests that does not show evidence of fire-destroyed forest growth. In stands of brush where growth studies of oak showed there had been no fire for more than 47 years were found numerous stubs of bigcone spruce and possibly Coulter pine. On other areas where mountain residents of many years standing declare positively that they do not recall seeing a single tree in the brush slopes, evidences of a former bigcone spruce stand is found.

Of the conifers growing in the chaparral, three may be termed strong species, for were it not for certain characteristics peculiar to them there would be no tree growth in the chaparral at the present time. These species are the bigcone spruce and the Coulter and knobcone pines. The former is a strong species because of its fire-resisting qualities and the ability of the seed to lie dormant in the litter without losing its vitality. Out of over 200 trees tallied on various old burns, 19 per cent were not destroyed, while all other mature conifers are killed by chaparral fires. Seeds sown in the litter from one to five inches deep retained from 10 to 25 per cent of their vitality at the expiration of two seasons, and the young seedlings are able to withstand much shade, growing rapidly when released. Coulter pine is classed as a strong species, for though the tree is readily destroyed by fire, much seed is borne annually, the seed is of good vitality, and when in the litter can withstand a light ground fire without severe hurt. Seed is retained in unopened cones from one to five years on

the tree, and this seed can pass through fires which totally destroy the parent tree, without deterioration, the seed being scattered when the cones open. Knob-cone pine is a strong tree because of its relatively rapid growth on dry sites, and the fact that the cones retain seed of good vitality for many years to be released after a fire.

In the past the fire rotation in the chaparral forests was something like 20 years longer on some areas than others, but since the Forest Service has developed its present efficient protective schemes, the rate of fire rotation has been increased to something like 200 years. This change is manifesting itself in the reproduction, for now young trees are showing up through brushy areas where their presence was never before suspected and where there are no evidences of a previous forest. With man aiding the forest by lengthening this rotation, the rapid encroachment of the forest upon the chaparral may be expected.

The successful planting of conifers in localities far from any tree growth also demonstrates the fact that this is really forest land. In one plantation Monterey and knobcone pines and deodar cedar are growing so rapidly and thriftily that they are shading out the brush and have built up a forest floor, having attained an average height of 16 feet and an average diameter of five inches in 15 years.

Chaparral has a marked effect on the reproduction of the trees. In heavy mature stands of oak, lilac, and kindred species, a heavy leaf litter from three to eight inches deep is formed. When this deep, it nearly always is matted firmly together, and one can lift large chunks of this material several inches thick without difficulty. Seed falling upon this and not finding conditions favorable for germination either lie dormant or rot. How long seed can lie in this duff without losing its vitality is not known, but with favorable conditions some seed will germinate on the surface, though some will be unable to reach mineral soil. It has been found that western yellow pine and bigcone spruce cannot send their radicals through two inches of this duff, Jeffrey pine through three inches, and Coulter pine through three and one-half inches.

In addition to offering a physical resistance to the germination of the seed, the chaparral harbors countless numbers of seed-eating rodents and birds who destroy immense quantities of seed, so that the chance of a few seed trees being able to seed down a large brush area is exceedingly slight. If, however, a seed year comes soon after a fire in which the seed trees have not all been destroyed, there is an excellent chance of tree growth getting a start to some extent before the rodents again become active.

After the seed germinates the greatest deleterious effect that the chaparral exerts on the young tree is the root competition for soil moisture, which in periods of drought is exceedingly harmful. Chaparral plants as a rule have a double root system. One of these lies close to the surface, where there is a mass of very fibrous roots, while a much deeper system, of which we know very little, grows to a depth of 30 feet and over. The roots nearest the surface are believed to become dormant as soon as the soil moisture is reduced to a point at which they can no longer function, and all water required by the plant is then furnished by the deeper roots.

With such an established root system the young tree is at a decided disadvantage, for it must reach that level from which it is able to secure enough water to sustain life throughout the long, dry season.

A study was made of the rate of growth of the Jeffrey pine under tree cover where the influence of shale on height growth was greater than that of root competition, and of trees growing in the chaparral, where measurements revealed the light to be less than under a tree cover but where the root competition was much greater. The results show to what extent the root competition affects the rate of growth, there being seven years difference in the between trees growing in the chaparral to a height of seven feet and those growing under tree cover. This difference can be explained only on the basis of root competition. After Jeffrey pine had attained the height of the chaparral it was found that the height growth was reduced 2¼ inches annually for a period of 16 years, and the height growth of the Coulter pine was reduced 1.7 inches annually for a period of nine years.

In plantations of the Jeffrey pine in chaparral on the same site and under the same conditions of soil, density of brush and species, it was found that where the chaparral roots were eliminated to a depth of 30 inches the height growth of the trees averaged 1.3 inches greater the first year after planting and 1.8 inches greater the second year than trees of the same stock planted in direct competition with the brush. Soil moisture determinations give a very good reason for this difference, as the chart evidences, being especially marked at the time when growth first begins.

The root systems of the brush are of great value in furnishing a most effective preventative against erosion and landslides. The roots which lie near the surface form a closely woven mat, which so binds the soil that there is little displacement during heavy storms, no matter what its character. Surface erosion, or sheet erosion, is therefore of

very minor importance from an area with a dense stand of brush uniform over the area, but after a fire has destroyed the cover these surface roots are killed and severe erosion takes place.

Landslides in dense stands are relatively frequent on steep slopes and are caused by a supersaturation of the soil mass. With plenty of the heavier, deeper root systems of the chaparral, these landslides cannot occur, but frequently the species forming the cover on such areas do not possess roots capable of anchoring the surface soil firmly in place. Studies of these slips show that the genera in the order of their importance in preventing these slips are: (1) oaks, (2) manzanitas, (3) sumacs, followed by other species, as the quinines, cascaras, and legumes, with greasewood bringing up the rear. In nearly every case it was found that when oaks were destroyed in these slips these deep roots were badly decayed, and it is well known that greasewood is weak, which would account for its place in the scale. It is apparent, therefore, that there is a direct relationship between the strength of these deep taproots and the number of landslides.

Another interesting thing in connection with the chaparral is the change in vegetation that takes place on an area following the removal of the chaparral cover: large numbers of herbaceous annuals and perennials spring up whose presence before had not been noted. On two areas, at an elevation of 4,300 feet, from one of which all the chaparral cover had been cleared, there were 37 species on the cleared area not found in the brush, the increase in the number of individual plants amounting to 164 per cent, while there were found in the chaparral five species not found on the cleared areas.

The same change in the character of the plants which spring up after the removal of the brush is also to be noted on fire areas. Here 21 species occurred which were not found anywhere in the adjacent brush. While the litter was not entirely destroyed, the number of individual plants per unit area was 75 per cent greater than on the area where it was entirely consumed. Similar studies were carried on by sowing litter obtained in the brush in the open, and species similar to those found on the burn and cleared areas were obtained, indicating that there were a large number of dormant seeds of various plants awaiting favorable conditions for germination, and also evincing the fact that the chaparral area formerly had been destroyed.

On the economic side, chaparral holds a future which is just beginning to be appreciated. For example, the yucca stem is being used for surgeon's splints and for tree protectors, while from yucca leaves

brooms and binder twine are being made, the latter product being superior to that obtained from the sisal, in having a longer and a stouter fiber. Manzanita and lilac root swellings are being made into pipe-stock material, the product equalling the briar importations. At the present time experiments are being carried on in determining whether manzanita will yield a dye such as the Indians formerly used, while the lilacs were used by the same peoples in making a soap. Oaks and mahoganies, though diameters of more than 4 inches are rare, are aiding in the present crisis by furnishing fuel material to a region where that commodity is lacking and expensive, and they are capable of renewing their stands in a few years by coppice. Hoop material for the cement industry is being sought for, due to the present difficulty in the transportation of freight, while novelties and souvenirs of many various kinds are being made from such woods as the lilacs, mahogany, and manzanita, which take a high polish and unique colorations. It is evident, therefore, that in these little-known forests are many problems awaiting solution—problems of an ecological nature, problems of streamflow and erosion, and problems of an economic nature—which invite the attention of the natural sciences, engineering, and forestry.

THE RELATION OF GRAY BIRCH TO THE REGENERATION OF WHITE PINE

By J. W. Toumey

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During the months of July and August, 1918, the writer made a series of field studies on the natural regeneration of white pine near Keene, in southern New Hampshire. The primary object of these studies was to ascertain so far as possible the effect of gray birch of varying ages and densities on white pine reproduction and on its rate of height growth. The studies were made for the most part on the forest owned by the Yale School of Forestry some two miles south of Keene. Some of the studies, however, were on privately owned forests west of Keene. All of the areas where studies were made are in or adjacent to the sand plain of the Ashuelot River. The underlying rock formation is granite, which appears at the surface only in a few places adjacent to the sand plain. A deep mantle of sand for the most part covers the rock formation. The surface soil where the studies were made is for the most part relatively free from stones, and is light, loamy sand, much better adapted for forest crops than for agriculture. It is better suited for white pine and red pine than for hardwoods. The writer knows no general locality better suited by nature for the growth of white pine, where natural reproduction can be more easily attained and where the young trees suffer less from competition with hardwoods.

Most of the lots near Keene owned by the School of Forestry are more or less completely stocked with white pine from natural reproduction. Until recently most of the young reproduction was overtopped by gray birch of varying ages and varying degrees of density. Approximately ten years ago improvement work was begun in removing the gray birch and thus exposing the pine to the light and air. The hardwood has been removed from considerable areas during the past four years; thus, during the past winter some 500 cords were cut, mostly gray birch from two to six inches in diameter and from 20 to 30 feet tall. These hardwoods formed a more or less complete canopy over the pine, or else when sufficiently open some of the pines reached into the hardwood canopy, where their tops were broken or badly whipped by the birch, due to wind action.

Three temporary sample plots, each 40 feet by 100 feet, were established on the Blake lot, where the birch and other hardwoods were removed from over the pine in the winter of 1917-18. Each plot was representative of different degrees of density of the overwood as determined by the number and diameter of the stumps. Plot I had the least degree of density; Plot II intermediate, while Plot III had the greatest degree of density. The problem was to ascertain, if possible, the effect of the hardwoods, chiefly gray birch, on the density of the white pine and on its rate of growth. On all three plots the birch and other hardwoods were 24 years old, and for the most part from sprouts following a clear cutting. The average height of the canopy prior to cutting the hardwoods was approximately 28 feet, as determined by adjacent stands of the same age as yet uncut.

Reducing the data derived from the sample plots to an acre basis, Plot I, with the least degree of density of hardwoods, had 610 hardwood stumps per acre from one to six inches in diameter, with gray birch forming practically all of the larger sizes. The white pines freed by the removal of the hardwoods were 1,230 per acre, for the most part of the same age as the overwood removed. Many of these pines extended up into the hardwood canopy, and in time would have outstripped the hardwoods and formed a practically pure pine stand. Under this density of hardwoods, chiefly gray birch 24 years of age, the number of pine was adequate for a fully stocked stand and had from the beginning made a very satisfactory growth, as but 272 out of 1,230 per acre were under eight feet in height. Although the tops of some were badly whipped by the birch, the removal of the hardwoods was not necessary in order to prevent loss due to shading or marked decrease in growth.

Plot II, with an intermediate density of hardwoods, chiefly gray birch, when reduced to an acre basis had 2,198 hardwood stumps per acre, one to six inches in diameter. The white pines freed by the removal of the hardwoods and with only a relatively small number reaching up into the birch canopy, were 2,428 per acre. They were with few exceptions of the same age (24 years) as on Plot I. *No pines were found that had been killed by competition with the overwood.* Those less than two feet in height were as old as those eight or ten feet tall. The denser overwood had no apparent effect upon the density of pine beneath its canopy, but compared with Plot I the pine was much smaller and more slender. The foliage was less and much more open. The chief effect of the increased density of the birch overwood was to restrict the rate of height growth of the pines and give them the appearance of being much less robust. *Under a*

density of 2,198 hardwood stems per acre, chiefly gray birch, with the trees 24 years old, from one to six inches in diameter and averaging 28 feet tall, there appeared to be no loss of white pine due to overshading. There had, however, been a remarkable reduction in growth as compared with Plot I. On Plot I but 22 pines per acre were below two feet in height, while on Plot II over 800 per acre were below. Moreover, the smaller pines were of the same age as the larger ones, being held back, due to the keener competition with the hardwoods. On Plot II, however, with 2,198 hardwood stems per acre, from one to six inches in diameter and 28 feet in average height, no pines had been killed through competition with the overwood, although they had been greatly checked in growth as compared with Plot I.

The annual height growth of the pines on Plot II during the past four years showed the average annual growth to be as follows:

Year	Height growth in inches
1915	5.4+
1916	5.8+
1917	5.1+
1918	3.4+

The growing season following the uncovering of the pine height growth was greatly reduced, although the trees appeared more vigorous and the needles were larger and more numerous. Not only in this instance, but in five other cases where measurements were taken on pines uncovered during other years, height growth the season following the removal of the overwood was reduced from 30 to 60 per cent from the average of the three years preceding its removal.

Plot III, with a very dense overwood of hardwoods, chiefly gray birch, when reduced to an acre basis, had 2,374 hardwood stumps per acre, with gray birch forming nearly all of the larger sizes and averaging considerably larger than on the two previously described plots, approximately 75 per cent being above three inches in diameter, while on Plot II less than 50 per cent were above three inches in diameter. It was clearly evident from the size and number of the hardwood stumps that Plot III had a much denser hardwood canopy before its removal in the winter of 1917-18 than either of the other two plots; moreover, the ground was lower and the soil moister. Not only were the gray birch stems larger and more numerous, but red maple, to considerable extent, replaced aspen in mixture with the birch. Plot III, with its great density of 24-year-old hardwoods, had in its understory 860 white pine trees per acre. They were, as in the other two cases, of the same age as the hardwoods. Over 70 per cent were less than two feet in height, about 10 per cent were over four feet tall,

and only ten trees per acre attained a height of six feet. *Even on this plot the great density of the birch did not prevent the persistence of the white pine beneath.* Its chief effect appeared to be to arrest the growth of the pine. Without exception, however, the foliage was short and sparse and the trees lacked vigor.

The average height growth of the pine during the past four years was as follows:

Year	Height growth in inches
1915	2.3+
1916	2.7+
1917	2.2+
1918	.9+

On this plot, 7 per cent of the pine, mostly in the upper height classes, died the growing season following the removal of the overwood, although the season was exceptionally favorable. From the data derived from Plot IV, which is discussed later in this article, it is believed the poor condition of the pine on Plot III and the loss after the removal of the overwood are not due so much to the density of the birch, but to the much denser foliaged red maple intermixed with it.

The above studies suggest that *gray birch at 24 years of age, and probably at all ages, is never so dense that white pine in southern New Hampshire will not survive beneath it. The growth of the pine, however, is governed by the density of the birch.* When the birch is moderately open, even with as many as 600 to 800 trees per acre up to six inches in diameter and 28 feet tall, the pine as a whole is not held back essentially in height growth, and the chief advantage in removing the birch is to prevent the whipping of the pine tops by the birch. As the density of the birch increases up to the maximum for the species, there appears to be no essential reduction in the number of pine beneath due to the birch, but there is a progressive falling off in height growth with increase in density, and it becomes necessary to remove the birch in order to secure adequate growth in the pine to justify its management as a pine forest.

What is the cause of the falling off in height growth in an understory of white pine when under gray birch, and why is there so little loss in the number of pine per unit of area even under the densest stands? *Is the poor growth due to the effect of the birch in withholding light, or is it due to root competition for soil nutrients and moisture?*

A carefully selected sample plot was laid out in a very dense stand of 18-year-old gray birch growing on a moist, loamy sand. On this

plot, 52 by 52 feet in area, out of 317 hardwood trees growing thereon, all but 16 were gray birch. They all originated from seed and were uniformly distributed over the plot. For the most part they were tall and straight, with the canopy 18 to 28 feet above the ground. The understory of pines was entirely below the birch canopy. Reduced to an acre basis, there were 4,816 birch stems per acre from one to six inches in diameter and approximately 200 small stems of poplar and black cherry. The white pine beneath this remarkably dense stand of 18-year-old gray birch were 432 per acre, of which approximately 25 per cent were over five feet in height. *The high quality of the site, particularly the better soil and moisture conditions, permitted a fair growth in the pine, even under the densest gray birch.* Measurements taken from a large number of trees showed the average height growth during the past four years to be as follows:

Year	Height growth in inches
1915	6.7+
1916	6.4+
1917	6.4+
1918	5.5+

Plot IV represents the maximum density of 18-year-old gray birch. Measurements were made at noonday, August 1, of the chemical light intensity under the average canopy of this plot. The measurements were made with the Clements photometer by exposing it while walking back and forth across the plot in two directions at six-foot intervals. The average chemical light intensity under this maximum density of gray birch canopy was 1/9 of full light. Only a short distance away white pine seedlings were abundant and growing well under an overwood of pine, where the average chemical light intensity measured the same day was 1/14 of full light, while pine reproduction did not entirely disappear until the light was reduced to from 1/25 to 1/35 of full light. *It would appear from the above that even under the densest gray birch there is adequate light for the persistence and growth of white pine.* Why, then, is the growth so greatly checked in the pine when under dense gray birch, particularly upon upland dry soils? It appears to be primarily, if not entirely, due to root competition for moisture and nutrients. On Plot IV, with more than 4,800 birch stems per acre, forming the overwood and evenly distributed, every square foot of the surface soil is occupied by the birch roots, and the understory of smaller pine has but little chance for adequate soil moisture and nutrients to sustain growth.

In the spring of 1917 a large area of almost pure gray birch, 23 years old and varying in density, was underplanted with white pine

and red pine transplants three years old. A plot 52 by 52 feet was laid out in this area in July last; the average crown density was 0.6 and the canopy extended to 22 feet above the ground. The overwood was entirely gray birch, which, when reduced to an acre basis, gave 1,232 stems per acre, of which number 338 were over three inches in diameter, the larger being six inches one foot above the ground. The average chemical light intensity under the canopy, based upon the average of 20 exposures made by passing back and forth over the area at six-foot intervals, was slightly more than 1/3 of full light. Height growth measurements on the planted pine under the canopy were as follows:

Species	Year	Height growth in inches
White pine	1917	3.3+
White pine	1918	5.4+
Red pine	1917	4.6+
Red pine	1918	4.5+

The height growth of both species averaged *less on those portions of the measured area where they were exposed to full light for considerable portions of the day.* Under gray birch of the above density there appeared as yet to be no apparent retarding of growth due to shade.

The following tentative conclusions have been drawn from this study:

(1) Pure stands of gray birch in southern New Hampshire are never sufficiently dense to cause the death from shading of white pine growing beneath.

(2) Natural reproduction of white pine under gray birch is for the most part of the same age as the birch.

(3) The rapidity of height growth in white pine under gray birch is dependent upon the density of the birch.

(4) The falling off in height growth of white pine with increase in the density of the gray birch overwood is chiefly due to competition for soil moisture and nutrients and not to the density of the shade cast by the birch canopy.

(5) Pure stands of gray birch of all densities may be underplanted with white pine and the birch removed when the slowing down of growth in the pine or the economic utilization of the birch makes it advisable. There is little danger that the shaded pine will be killed by competition for light with the birch.

(6) There appears to be a decided economic advantage in planting white pine under gray birch over cutting the birch and planting later. In the former case the need for cleanings to free the pine from sprouts after the birch is cut is not so great.

THE INFLUENCE OF THINNING ON WESTERN HEMLOCK AND GRAND FIR INFECTED WITH ECHINODONTIUM TINCTORIUM

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The opening up of a stand of timber by the methods as practiced in present-day private logging operations is usually brought about by the cutting and removal of the most valuable of the tree species and leaving the inferior or less valuable material standing. In many instances on National Forests definite thinnings or selection cuttings are made as a predetermined system of forest management. As a result of these activities, especially the earlier logging and timber sales operations, there are many logged-off areas which have a considerable stand of the so-called inferior species left growing. These areas form admirable sites for the study of the influence which thinning bears on the problem of the decay in this type of stand and the probable sanitation effect it may have on the surrounding forest. It is well to mention here that thinning as used in this article refers not to a particular process, such as selection cutting, but is used as a term indicating the removal of a certain portion of the original stand. It is a well-known fact that the thinning of a stand very appreciably affects the vigor and size of the remaining trees and is not alone due to the increased light, but must also depend greatly upon the increased root space and moisture content of the improved soil.[1] The aim of this paper is to determine, if possible, the influence which the thinning of a stand and the opening of the crowns to full light might exert upon the development of the trees in question in respect to vigor, annual growth, etc., and to note the effect this might have upon certain phases of the life of the fungus infecting them.

The study should develop the part which light plays in increasing the crown and increment, and thereby the vigor, and should bring out the relation which the action of full sunlight has upon the sporophores produced by a tree infected while in the original stand.

[1] Zon, R., and Graves, H. S.: Light in Relation to Tree Growth. 1911. U. S. Dept. Agr., For. Service Bul. No. 92, p. 18.

DESCRIPTION OF AREAS STUDIED

The areas included in this study lie in the river-bottom flats of the Priest River Valley, in Idaho. They are typical of the river-bottom type of forest common in this region and in the Kaniksu National Forest. The mixture of the original stand consisted of western white pine (*Pinus monticola*), grand fir (*Abies grandis*), western hemlock (*Tsuga heterophylla*), western red cedar (*Thuja plicata*), western larch (*Larix occidentalis*), and Douglas fir (*Pseudotsuga taxifolia*) in the order of their numerical occurrence. The density of the original stand before logging was approximately 230 trees per acre, including all trees to a lower diameter limit of 2 inches (breast high). The soil is a sandy loam, with a thick covering of humus, needles, and logging debris. Owing to the heavy rainfall and poor drainage, the site is very moist during the greater part of the year. Previous to 1915, no fires had produced visible damage on this area during the life of the present stand. A majority of the original stand had been cut during the period between 1900 and 1902 for its merchantable timber, leaving the western hemlock, grand fir, and a few of the smaller individuals of Douglas fir and larch standing on the area. The average density of the stand remaining on the areas after logging, computed from the data, is approximately 50 trees per acre. This forms a very open stand of hemlock and grand fir.

In all 5 plats were laid out on the cut-over areas, comprising a total of 9.5 acres, upon which 435 trees, 57 of hemlock and 375 of grand fir, were studied.

FIELD METHODS

The methods used in securing the data are as follows: Plots were laid out and detailed forest descriptions of each plat were recorded. The trees were then prepared for examination by first lightly blazing the bark and inscribing a number on the smoothed surface by means of lumbermen's crayons. The trees were numbered successively from 1 to 435 and all data were recorded under the given numbers.

The increment borer of And Mattson, 14 inches in length, was successfully used in securing borings at diameter breast height, from which the approximate total age and the measurements of the width of annual rings for the last two decades were secured. A very good indication of decay was also secured by this means, in conjunction with observations on the presence of sporophores and the soundings made on the trunk. Out of 120 hemlocks felled and opened up for the detection of

rot on adjoining areas 116, or 96.6 per cent, of the trees showed typical rot in the stump section, and out of 75 grand firs similarly treated 72, or 96 per cent, showed typical rot at the stump. In most cases several borings were made in the same tree in order to secure a boring which expressed an average condition of the annual rings, and also included the pith, or center, of the heartwood whenever this was not too badly rotted. The tree was recorded as being infected whenever the core of the boring gave evidence to the presence of rot. The measurements on the cores taken from the tree were made immediately, so as to lose nothing by the shrinkage of the wood and to guard against future possible loss. The cores were given the same number as the tree from which they were taken, an indelible pencil being found very useful in this numbering. A device for receiving the core of the boring as it emerged from the tree was made from one-inch stems of the common elderberry fashioned into a trough. By this method the cores were extracted without loss or further breakage and allowed of much greater accuracy in making the measurements and counting the rings.

The total height of the tree as well as the lengths of the original and secondary crowns were accurately computed by the use of a Klaussner hypsometer. The crown widths were secured by measuring the length of an average lower branch of each crown and multiplying by two. The viability of the sporophores was determined principally by the presence or absence of the fresh, white hymenial layer, and in doubtful cases the fruiting bodies were removed from the tree and carefully examined. Sporophores which were alive the preceding year and as yet gave no evidence of imminent sporulation showed a zone of fresh brown tissue of last year's growth on the outer edge. These were classed as live. The age of the sporophores as determined by the annual zones was an important part of the data. In many cases the trunk of the tree was chopped into where it was thought necessary to examine the wood tissues directly adjacent to the sporophores. Since several borings were made in most cases at different points on the circumference at diameter breast height, and since the increment in dominant or isolated trees is chiefly in the lower portion of the trunk,[2] it is believed that the readings taken from the cores will prove to be true indications of the variations in annual increment during the 20-year period. The large number of trees entering into the data will serve also to lessen the possible error due to the unequal distribution of increment. Trees of all ages and sizes were grouped together in compiling the data used for the curves. A general average of the growth of all

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[2] Loc. cit. (1).

the trees on the area for each separate year for a period of 20 years was desired.

THE INFLUENCE OF THINNING ON WESTERN HEMLOCK INFECTED WITH ECHINODONTIUM TINCTORIUM

It is evident that the various environmental factors tend to influence the vigor of the tree, and the vigor in turn presumably determines the ability to resist fungous attack. The part which light plays in the full development of a tree is important, although, according to Zon and Graves,[3] there are other factors concerned in the production of increased increment due to the opening up of a stand. The process of thinning has always been used with the belief and justified by the experience that the remaining trees left standing would show an appreciable increase in development soon after the stand was opened to more light and upon the establishment of less root and crown competition. The principal effect to be noted in the development of the trees so favored is a marked increase in the amount of wood laid down annually. This physiological reaction is a direct indication of the increased vigor of the tree and is a means by which foresters are able to judge the alternate periods of low and high vigor. With the purpose of recording the effect that thinning has upon western hemlock and grand fir infected with *Echinodontium tinctorium*, the following data were secured. The field data were grouped under the two tree species and separate tables composed accordingly.

The data on western hemlock were concentrated by means of averages, totals, etc., into one table, and from that portion of it which gives the average width of the annual rings a curve was platted (fig. 1). This curve serves to show graphically the marked effect produced by the opening up of the stand. From the various plots examined a total of 57 hemlock were analyzed, ranging in age from 48 to 116 years, and giving the average age for the stand at approximately 72 years. The hemlock curve (fig. 1) shows a slight suppression period between the years 1897 and 1899, followed in 1900 by a slight rise. In 1902 the curve drops to its lowest point, and seems to indicate the effect or shock of the sudden opening of the stand, with its attendant injuries to various portions of the tree. The unusually large amount of logging injuries, including stripping of live branches from the trunks and injury and exposure to the root system, were successfully healed by the increased activity of the trees. In 1903, the year following the close of

[3] Loc. cit. (1).

the logging operations, a slight increase is again noted, indicating a recovery from the low vigor period. From 1903 to 1908 a very rapid growth is indicated, followed by depression points in 1910 and 1913. The measurements for 1915 do not represent the entire year's growth, since the records were taken during the latter part of that summer. The curve shows plainly the effect of the thinning as influencing the annual growth in hemlock, and records the reaction to the shock of exposure as well as the response to environment following the cutting.

In comparing the two curves and the data from which they were

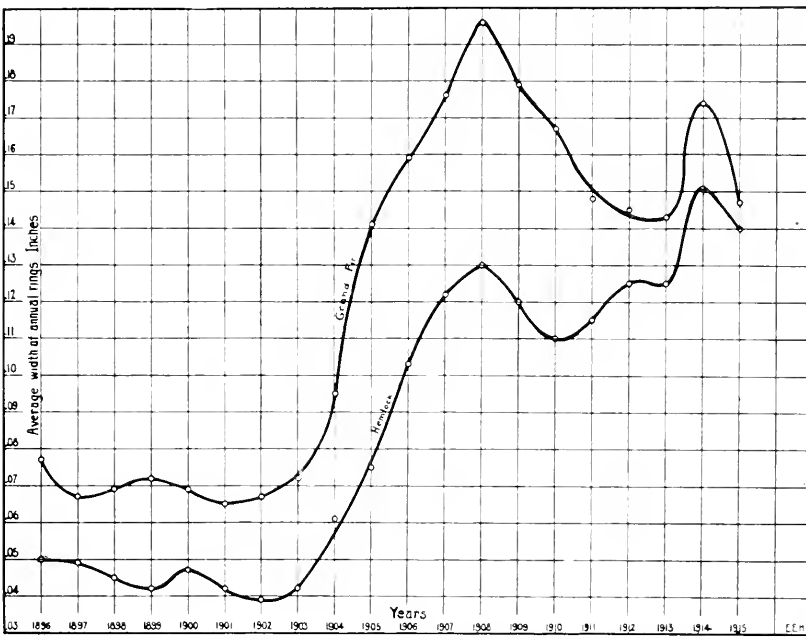

FIG. 1.—*Curves for western hemlock and grand fir, showing the increase in width of annual rings due to thinning*

platted, it is found that the hemlock responded more vigorously to the thinning than did the grand fir. In hemlock the increase in periodic annual growth for the period 1903 to 1915, inclusive, over the period from 1896 to 1902, inclusive, is 242 per cent. A like figure for grand fir is 216 per cent—a balance in favor of hemlock of 26 per cent.

A comparison of the average crown of the hemlocks upon the thinned area and those upon the unthinned area (Table 1) shows a striking contrast. The average crown size of the hemlocks on the cut-over area is 1,065 square feet and on the uncut area 374 square feet. The differ-

TABLE 1.—*Comparison of Data Taken on Cut-over and Uncut Areas*

Areas.	Average age, years.	Average, d. b. h., inches.	Average height of tree, feet.	Average size of original crown—length by width—sq. feet.	Average secondary crown.	Basis number of trees.
Cut-over area.......	72.2	11.0	64.3	1,064.7	Original crown much thickened.	57
Uncut area.........	78.3	6.05	43.7	374.3	None....	120
Cut-over area after allowing for original differences in stands based upon difference in mean annual diameter growth.	72.2	6.50 —41%	37.9 —41%	628.2 —41%	None....	(103)

TABLE 2.—*Comparison of Data Taken on Cut-over and Uncut*

Cut-over area.......	64.5	12.09	69.2	901.2	170.7	375
Uncut area.........	71.5	7.1	56.8	322.3	None....	75
Cut-over area after allowing for original differences in stands based upon difference in mean annual diameter growth.	64.5	7.7 —36%	44.3 —36%	576.8 —36%	None....	(458)

a Secured by subtracting the increased diameter growth due to thinning for a period of 13 years from the average diameter given in above table. The remainder is divided by 72.2, the average age of the stand.

of Same Type and Site. Western Hemlock. River-bottom Type.

Total number of sporophores.		Total number of trees.		Total number of trees bearing sporophores.	Total number of trees showing rot at stump.	Mean annual diameter growth, inches.	Original density in total trees per acre, number.
Live, number.	Dead, number.	Sound, number.	Infected, number.				
10 (32.2%)	21 (67.8%)	19 (33.3%)	38 (66.7%)	13 (22.8%)	38 (66.7%)	0.129*a*	225
131 (87.9%)	18 (12.1%)	4 (3.3%)	116 (96.7%)	70 (58.3%)	116 (96.6%)	0.076	280
24 (67.0%) +143	12 (33.0%) —41%	11 (11%) —41%	92 (89%) +143%	32 (31%) +143%	92 (89%) +143%	0.076 —41%	225

Areas of Same Type and Site. Grand Fir. River-bottom Type.

Total number of sporophores.		Total number of trees.		Total number of trees bearing sporophores.	Total number of trees showing rot at stump.	Mean annual diameter growth, inches.	Original density in total trees per acre, number.
Live, number.	Dead, number.	Sound, number.	Infected, number.				
34 (13.9%)	211 (86.1%)	180 (48%)	195 (62%)	92 (27.2%)	195 (62%)	0.155*b*	225
110 (80.0%)	28 (20.0%)	0	75 (100%)	65 (86.6%)	72 (96%)	0.099	280
94 (41%) +176%	135 (59%) —36%	115 (25%) —36%	343 (75%) +176%	162 (35%) +176%	343 (75%) +176%	0.099 —36%	225

b Secured by subtracting the increased diameter growth due to thinning for a period of 13 years from the average diameter given in above table. The remainder is divided by 64.5, the average age of the stand.

ence in original densities between the two stands compared on a basis of all trees found on the area to a lower diameter limit of 2 inches (breast high) may serve to reduce the apparent difference. The density of the uncut area was found to be approximately 280 trees per acre, and that of the cut-over area previous to logging 225 trees per acre. This indicates the uncut area is denser by at least 20 per cent, but the figures show that the average crown for the cut-over area is approximately 185 per cent greater than that for the uncut area. A comparison of the mean annual diameter growth of the hemlock on the uncut for the period of its life up to 1915 and the hemlock on the cut-over area for the same period shows a difference in growth of 143 per cent in favor of the cut-over area. The crowns of the trees in the uncut area disclosed no such thickening by additional twigs as did those of the cut-over area. The larger crown sizes and the evident increase in the width of the annual rings for the hemlock on the thinned areas are correlated and indicate increased vigor.

The data collected show the majority of the injuries received by the hemlock to be healed. Some of the old branch stubs were found entirely occluded by the rapid growth, a further evidence of increased vigor. Most of the frost cracks were found healed on the cut-over area, while on the uncut area the majority found were unhealed.

In comparing the infected and uninfected trees of both areas (Table 1), another point which may indicate the effect of thinning is noted. On the cut-over area, out of a total of 57 trees, 19, or 33 per cent, were found to be sound and 38, or 67 per cent, were infected in varying degree by the fungus *Echinodontium tinctorium.* On the uncut area, out of a total of 120 trees, only 4, or 3 per cent, were found to be sound, while 116, or 97 per cent, were infected in varying degree by the same species of fungus.

The comparison of the sporophore data in Table 1 for the two areas gives the following: On the cut-over area 32 per cent of the total sporophores found gave evidence of being alive, while 68 per cent were unable to continue alive, the majority drying out and dying after a period of from 1 to 3 years. The uncut area shows 88 per cent of the total sporophores alive and only 12 per cent dead, or 56 per cent more live sporophores than on the cut-over area. Of the sporophoro-bearing trees the cut-over area has 13 out of 57 trees, or 23 per cent, bearing sporophores either live or dead or both, while the uncut area has 70 out of 120 trees, or 58 per cent. These data indicate that the greater amount of infection is found on the uncut area, where the trees are crowded and suppressed, than on the cut-over area, where the stand is

very open. The difference in the original densities of the two stands no doubt brings these comparison figures nearer each other, but it is not believed that this difference could be entirely responsible for the great variance in number of live sporophores and in number of sporophore-bearing trees exhibited by the data for the two areas.

THE INFLUENCE OF THINNING ON GRAND FIR INFECTED WITH ECHINODONTIUM TINCTORIUM

The similarity of the general trend of the two curves (fig. 1) is very pronounced, indicating a simultaneous, although not equal, effect produced by the opening up of the stand. In order to ascertain whether the rainfall of the region for the various years had a marked effect in the variations shown by the two curves, a graph was platted, using the U. S. Weather Bureau reports as the source of the data. No direct correlation could be traced between the three, the periods of greatest annual precipitation often coinciding with or preceding the low vigor points in the curves and *vice versa*. Kirkwood[4] has shown that in trees growing upon areas where the effect of precipitation is most apparent in the seasonal growth of the tree a direct relation can be traced between the year of drought and the following season's growth. No doubt in very moist situations such a reaction would not be possible.

The influence of thinning on grand fir is quite similar to that produced in hemlock, although to a lesser extent. The comparison data given in Table 2 show clearly the larger size measurements of the trees in the cut-over area as compared to the uncut area, the most pronounced contrast being evident in the sizes of the original crowns and the presence, in the case of the trees in the cut-over areas, of the secondary crowns. A few words should be said here in reference to these unusual productions of secondary branches. Tolerant tree species show a greater and more rapid response to increased light in the matter of crown expansion and in the development of adventitious shoots from the older parts of the tree than intolerant species. The presence of dormant buds on the older parts of the trees, lasting over for many years from the time of their origin, is a characteristic of grand fir. Very frequently these dormant buds are congregated in one place from 1 to 4 feet from the ground and form raised burrs, or burls, on the trunk. The axis of these buds extends usually in very regular, finely radiating lines from the point of origin in the pith to the outer surface,

[4] Kirkwood, J. E.: The Influence of Preceding Seasons on the Growth of Yellow Pine. 1914. *In* Torreya, v. 14, no. 7, pp. 115-125.

the cambium, and seldom shows the sinuous course so characteristic of adventitious structures in the wood of maples and other broadleaf species. The increased food supply induced by the thinning is also a factor in initiating the growth of these buds. They are generally located at the branch whorls, and they are capable of growth up to the period in the life of the tree when very thick bark is produced. Consequently, on the lower part of the trunk of the oldest trees these buds may die out.

The data on the cut-over area show the average original crown size for grand fir to be 901 square feet, with an average secondary crown of 171 square feet, or a total average crown of 1,072 square feet. The average size of the original crown for grand fir on the uncut area is 322 square feet, which leaves a balance of 233 per cent in favor of the cut-over area. The uncut area is denser than the original cut-over area by 20 per cent. The mean annual diameter growth on the cut-over area for the period up to 1915 is 176 per cent greater than a similar figure for the uncut area. These figures plainly indicate the grand fir on the uncut to be suppressed to a greater degree than was the original stand on the cut-over area.

The sporophore data (Table 2) exhibit an important contrast between the percentages of live and dead sporophores. On the cut-over area only 14 per cent of the total sporophores were alive and 86 per cent were dead, while on the uncut area 80 per cent of the total sporophores were alive and only 20 per cent dead. In summing up the total number of trees bearing sporophores on each area, it is interesting to note that in the cut-over area 92 out of 375 trees, or 27 per cent, were found bearing sporophores, while in the uncut area 65 out of 75 trees, or 87 per cent, were found to bear sporophores. This result compares with a like result obtained for hemlock, and gives further evidence of the greater fungous activity to be found in the trees of the uncut area.

In the cut-over area, out of a total of 375 trees, 180, or 48 per cent, were found to be sound and 195, or 52 per cent, were found infected in varying degrees. In contrast to these figures, out of a total of 75 trees taken on the adjacent uncut area, none were found sound, giving 75 trees, or 100 per cent, infected in varying degrees. In the thinning stand 48 per cent of the trees are free from infection. Out of a total of 245 sporophores (dead or alive) produced on the cut-over area 86 per cent were found dead, leaving only a very small percentage living, and these were found to be small and in every way inferior in spore production to the live sporophores of the uncut area. In this consideration the drying effect of thinning upon the sporophores produced, as well as the action of the direct light, tend to gradually check the devel-

opment of the fruiting bodies, and the result is a crop of small, inferior sporophores, which in most cases die out in the course of from 1 to 4 years.

Similar observations on the amount and state of injuries were made for grand fir as for hemlock. In the case of grand fir much root exposure was recorded and a large amount of injuries, including many broken tops, was observed. Several of the broken tops were caused by the weight of an enormous cone production, which was in progress at the time the field data were taken (1915). Many of the tree-tops were bent over with the additional weight, and the addition of moisture or the force of the wind was in many instances sufficient to break the stem.

THE VALUE OF THINNING AS AFFECTING ECHINODONTIUM TINCTORIUM IN WESTERN HEMLOCK AND GRAND FIR

It is deemed unnecessary here to enter into a lengthy discussion of the effects produced by thinning, from a forester's point of view. The process of thinning has long been practiced in foreign forestry operations and enters vitally into the forestry policies of this country, where it is better known as one of the systems of forest management under the name of selection cuttings. Some of the recent literature dealing in part directly with the influence and effect of thinning is interesting. Mason,[5] in a discussion of the light requirements of lodgepole pine, gives some interesting points in connection with thinning. A release from a suppressed condition by means of thinning was found to result in a very marked increase in growth, amounting in one example cited to an increased growth of 772 per cent in the last 12 years of growth over the preceding 12 years. Tables are also included in the work, showing the marked increase in the periodical annual diameter growth due to the influence of thinning.

Mattoon[6] gives some very interesting and striking examples of the effects of thinning caused by three different agencies—ice storms, tornado, and by logging operations. All three agencies resulted in thinning the stand, and the stimulation in growth was very marked, the trees formerly suppressed growing relatively much faster.

More recently Roth,[7] working with firs and birches, traces the effects produced in the year rings by the influence of three intermittent thin-

[5] Mason, D. T.: The Life History of Lodgepole Pine in the Rocky Mountains. 1915. U. S. Dept. Agr. Bul. No. 154, pp. 1-35.

[6] Mattoon, W. R.: Life History of Shortleaf Pine. 1915. U. S. Dept. Agr. Bul. No. 244, pp. 32-34.

[7] Roth, Julius: Beiträge zur Lichtungsfrage. *In* Forstwissenschaftliches Centralblatt. Jan., 1916, pp. 43-48.

nings. The data recorded show a striking increase in the width of the annual rings soon after the thinnings were made. He concludes that "the width of the annual rings diminishes toward the top (of the trunk), although the increase in growth in comparison with the earlier development is there also very great," and states further that the reason for the added increment being deposited in the lower trunk is not very clear.

The present studies have shown both for hemlock and grand fir that the thinnings very markedly affected the diameter growth, the total height, and the size of crowns, producing in the case of grand fir a distinct and separate secondary crown. The data are to be accepted as evidence that through thinning the trees have recovered from suppression to a remarkable extent and have passed from a low to a high vigor status. The increased vigor has been made evident through greater increment. In co-ordination with these physiological activities the crowns have developed to as much as twice their former size in the case of the hemlock and produced secondary crowns equal to and at times surpassing the original crowns in the case of grand fir. Such activity and renewal of vigor cannot help but possess beneficial effects in respect to the development of the tree and, it appears, must also play an important part in checking the number of sporophores produced on the trees.

In order to determine the possible effects of thinning upon the two tree species studied, the data for both hemlock and grand fir in Tables 1 and 2 respectively were reduced or increased according to the signs indicated in each column and to the percentage indicated. This was done to allow for the original differences between the two stands prior to cutting operations and was based upon the differences between the mean annual diameter growths of the trees on the two areas. In hemlock the mean annual diameter growth on the cut-over area was found to be 143 per cent greater than a similar figure on the uncut area and, *vice versa*, 41 per cent less. Thus, as an example, by reducing 11 inches, the average diameter breast height for the cut-over area, by 41 per cent gives 6.5 inches as the average diameter (breast high) for the cut-over area after reduction. This comes within 0.45 inch of the average diameter (breast high) given for the uncut area. In the continuation of this process the number of live sporophores was increased by 143 per cent, as was the total number of infected trees and the total number of trees bearing sporophores. The +143 per cent and —41 per cent were applied according to whether the reduction of the original

cut-over area to a condition nearly equal to the uncut area called for a subtraction or an addition.

In Table 1, comparing the total figures in the uncut area with the figures given for the adjusted cut-over area, the cut-over area has almost similar averages for age, diameter (breast high), and height, a much larger average crown, 21 per cent fewer live sporophores, 21 per cent more dead sporophores, 8 per cent more sound trees, 8 per cent fewer infected trees, 27 per cent fewer trees bearing sporophores, 8 per cent fewer trees showing rot at the stump, and identical figures for mean annual diameter growth and for density.

In Table 2 a similar comparison shows the grand fir on the cut-over area has almost similar averages for age and diameter breast height, an average height greater by 13 feet, a larger original crown and a large average secondary crown not possessed by the trees on the uncut area, 39 per cent fewer live sporophores, 29 per cent more dead sporophores, 25 per cent more sound trees and 25 per cent fewer infected trees, 52 per cent fewer trees bearing sporophores, 25 per cent fewer trees showing rot at the stump, and identical figures for mean annual diameter growth and for density.

On the other hand, the activity of the fungus is much more pronounced in the uncut stand, where all the environmental factors favor the progress of infection and decay. Here the vigor is greatly lowered, due to the crowding of the stand, and by reason of this density and its resultant shade the lower portions of the crowns die out, causing the formation of dead branches and branch stubs, which become open to infection. The shade produced by this crowding and its attendant moisture conditions also favors the germination of the fungous spores. In the cut-over area these factors are all reversed. Crowded conditions give way to an open stand, light is admitted to the greater portion of the tree, secondary crowns and secondary thickening of old crowns are produced in place of dead branch stubs, and the vigor is greatly increased. The annual rings become much wider, the effect being evident soon after thinning, and consequently the trees show a larger diameter growth. Conditions unfavorable to the germination and penetration of the fungous spores are established and the data indicate, although not conclusively, that the activities of the fungus within the tree as regards the development and viability of the sporophores is appreciably curtailed. The old sporophores that developed on the trees while still in the forest had in most cases died and were completely separated from the old pin knots by 5 or 6 layers of living wood. The old branch wounds were thus completely occluded and the sporophores

were merely suspended, attached to the bark. Many of the trees (101 out of 195) that were infected disclosed in the borings taken that the rot was in its typical stage (well established), had not produced sporophores while in the forest, and had not done so since the thinning. In fact, the decayed wood of such trees had taken on the nature of a soft rot, differing in every respect from the typical decay produced by the fungus under the favorable conditions of the closed forest.

These comparisons show a balance in favor of the thinning influence in every case, and also show that the method of bringing the two stands on a more nearly comparable basis has aided in securing more nearly correct results. These data indicate that the opening of a stand to full sunlight after a period of suppression apparently influences the development of the attacking fungus.

Fungi and fungous fruiting bodies are tolerant of shade. This point need not be discussed. Since moisture forms one of the prime necessities of plant life, especially fungi, it must follow that the shaded, and therefore more humid, situations would be the most favorable ones. Much sunlight and exposure to unfavorable drying conditions increases the transpiration at the hymenial surface of *Echinodontium tinctorium*, just as in the case of green leaves, with the result that this layer soon dries out and dies. This is, no doubt, the effect produced upon some of the sporophores found on the trees of the cut-over area by the opening of the stand and the extreme change in density from 225 trees per acre in the original stand to 50 trees per acre left after the logging operations. Several live fruiting bodies of the fungus were produced on this area, yet the conditions of increased vigor and light, the diminished shade and moisture, and the absence of many open injuries are extremely adverse to the germination and development of fungous spores. Provided thinning caused a very appreciable restrictive influence upon the fungus infecting hemlock and grand fir, it would not be advisable to depend upon such a method of forest sanitation in outlining means of controlling the spread of this fungus. In cases where the destruction by fire of all infectious cull material and standing infected trees left on an area after logging cannot be enforced, it might be found beneficial to leave as open a stand as possible in order to create an environment less favorable to the development and spread of the fungus.

SUMMARY

The main facts brought out by the data, compared with the analysis of trees taken from an adjacent uncut area of the same type and age

class, but having a somewhat lower mean annual diameter growth for the period prior to the thinning, are as follows:

The thinning produces in both trees a very marked increase in the width of the annual rings, being more marked in the case of hemlock.

A larger diameter, height, and crown growth is recorded for both species of tree growing in the cut-over area. In the case of the hemlock a very marked secondary growth of the old crown takes place, while in the grand fir a distinct secondary crown appears on the lower trunk below and intermingled with the original crown, this secondary crown in many cases extending to within a few feet of the ground. More injuries were found on trees on the cut-over area and a greater number healed than on the uncut area. These facts indicate a greatly increased vigor.

A comparison of the cut-over and uncut areas after the figures for the cut-over area had been adjusted, so as to be more nearly comparable with those of the uncut area, shows the following results: The mean annual diameter growth for the cut-over area was found to be 143 per cent greater in hemlock and 176 per cent greater in grand fir than a similar growth for similar tree species upon the uncut area. These figures formed the basis for adjusting the figures of the cut-over area to those of the uncut area.

A comparison of the data thus secured indicates that a less favorable condition for fungous activity exists within the cut-over area, and shows plainly that a highly favorable environment for the fungus is present in the uncut area. The total number of infected trees, the total number of live sporophores, and the total number of sporophore-bearing trees are comparatively less on the cut-over area for both species of tree.

A conclusion is reached that the influence of thinning very appreciably affects the vigor of the trees on the cut-over areas, as shown by the increased diameter, crown, and height growth, as well as the number of injuries healed.

That a restrictive influence due to thinning is apparently exerted upon the activities of the fungus *Echinodontium tinctorium* infecting hemlock and grand fir. The increased light, the absence of maximum moisture conditions and shade common to timber stands of this region, and the increased light due to thinning are apparently unfavorable to the germination and penetration of the fungous spores.

The thinning influences affecting the fungus *Echinodontium tinctorium* are not of sufficient importance to cause any variation from the predetermined sanitation rules to be applied to these species of trees.

APPRAISAL OF FIRE DAMAGE TO IMMATURE TIMBER FOR STATISTICAL PURPOSES

By F. G. Clark

Forest Examiner, U. S. Forest Service

There has always been a need for a method of appraising fire damage to immature timber when the values obtained are to be used for statistical purposes. In general, these values have been arbitrarily fixed for the various species, or a flat rate applied to all, with no great thought toward working these values out on a definite basis or differentiating between the different species. It is believed that basis for these values should be expressed in a formula to be used in preparing a table of values which will give consistent results when applied to any given region and to any given number of species.

The use of straight expectation or replacement methods when applied to a region in the estimating of reproduction killed by fire, especially when that value is to be used for statistical purposes only, do not give satisfactory results. The principal disadvantage of the expectation method is that the major premises—the stumpage price and the yield—must be assumed. One other disadvantage of the expectation method is that the younger age classes of our slow-growing species, as the yellow pine and Douglas fir on the poorer sites, show a negative value, after assuming average yields and moderate stumpage prices.

On the other hand, a straight replacement formula with only variations being due to difference in cost of growing nursery stock and field planting. The market value of the wood or its intrinsic qualities has no place in the formula.

A modified replacement formula is proposed in this paper which is intended to overcome the difficulties mentioned. It is modified in the following respects:

1. The cost of planting is reduced by a percentage represented by the proportion of artificial to natural reproduction which experience indicates holds good over large burned areas.

For example, if it is found that it will be necessary to plant 30 per cent of all burned area in a region in order to secure satisfactory restocking, then 30 per cent of the planting charge per acre would be assessed against every acre burned. This figure may, of course, be changed for each type or for each species if the

facts warrant; but it is a much simpler process and more in keeping with the purpose for which the formula is intended if one standard figure for all types in a region is used.

2. The resulting values for each age class are prorated to the different species in accordance with their present relative commercial values.

If these values were used directly in the formula they would give values that are too high and make necessary the use of a reducing factor. This factor must be dependent on the relative commercial values and should place each value dependent on the others. It is obtained by dividing the number of relative commercial values by their sum, and is shown in the following formula by the expression of $\frac{N}{SR}$. This is a partial weighted average of the relative commercial values. Under this condition, if one of the relative commercial values is changed, then the value of $\frac{N}{SR}$ is changed, which of course directly affects all values that may be computed. This then becomes a reducing factor which is dependent on the relative commercial values.

For example, if the relative commercial values of several species are 5, 3, 2, and 1, this gives four relative values, which may be represented by "N". Their sum is equal to 11, which may be represented by SR, where R represents each of the values, 5, 3, 2, or 1. Then $\frac{N}{SR}$ is equal to $\frac{4}{11}$.

The formula as proposed, with the above-mentioned modifications, is as follows:

$$V = R\left\{\frac{N}{SR}\left[C\ (1.0p^{m})\ (a) + \frac{E\ (1.0p^{m} - 1)}{1.0p - 1}\right]\right\}$$

Where V = Value per acre for any species or age class.
R = Relative commercial values of the various species.

In applying the formula to northern Idaho and Montana these have been assumed as follows:

White pine	5
Yellow pine, cedar, and spruce	3
Larch and Douglas fir	2
Lodgepole pine	1

"R" is here equal to 5, 3, 2, or 1, depending upon the species under consideration.
N = Number of relative values, or 4.
SR = Sum of relative values, or 11.
C = Average cost of planting, or \$5.
P = Interest rate of 3 per cent.
m = Average age of stand destroyed.

a = Fractional part or percentage of whole area burned over which needs replanting. This is placed at 30 per cent. May be varied, of course, for each species or type.

E = Cost of protection and administration per acre per year. This is placed at 4 cents.

From these approximate data the following table has been computed, the values being rounded off to the nearest half dollar:

Species	Average age of stand			
	10 years	20 years	30 years	40 years
White pine	$4.50	$7.00	$10.00	$14.50
Yellow pine, cedar, spruce	2.50	4.00	6.00	8.50
Larch, Douglas fir	2.00	3.00	4.00	4.50
Lodgepole pine	1.00	1.50	2.00	3.00

In applying the table to mixed stands consideration should be given the percentage of species in the mixture and the proportionate values of each species used. The same principle should be used for the value of understocked stands, since the table is based on fully-stocked conditions. For protecting forests an arbitrary value per acre for all species is satisfactory.

In actual practice the data should, of course, be carefully worked out. It has been approximated in this article without a great deal of investigation for purposes of illustration. The most difficult premise to secure will no doubt be the fractional part of the burned area necessary to plant. Extensive planting reconnaissance will do much toward clearing up this point.

It is realized that the method probably will not fit purely local conditions, but it is believed for statistical purposes it will approximate very closely the average value of the reproduction destroyed as nearly as can be determined when applied to an entire region.

BEAR CLOVER

(*Chamæbatia foliolosa* Benth.)

(MOUNTAIN MISERY, BEAR-MAT, TARWEED)

By J. A. Mitchell

Forest Examiner, U. S. Forest Service

No one can travel far through the Sierras of California without becoming more or less familiar with this abundant, strong-scented, low-growing shrub. Throughout the pine belt it occurs in great patches, acres in extent, forming a dense mat or ground cover a foot or so in depth. Often in open stands of western yellow pine it extends for miles, for all the world like a great green carpet. In early summer its millions of dainty white blossoms against the vivid green of new leaves make a sight never to be forgotten. From a practical standpoint, however, few plants are less useful or more obnoxious both to the stockman and the forester; for, of no value in itself, it occupies the ground to the practical exclusion of all other species.

Botanically speaking of the rose family, bear clover is characterized by minutely divided fern-like leaves, a white five-petaled strawberry-like flower, sticky foliage, and a rank aromatic odor. The latter characteristics are so marked as to give it the name "tarweed" in certain localities and serve generally to identify it. Any one who has once walked through a patch of it and smelled the pungent aromatic odor it gives off when bruised is certain to remember it. The plant itself is a low, woody evergreen shrub, growing from one to two feet high, with numerous slender branchlets. It has a long taproot and many laterals, which send up shoots at frequent intervals. This habit of sprouting accounts for its rapid spread and its ability to withstand repeated fires. In addition, it produces seeds abundantly and reproduces itself readily in this manner, particularly on areas where the mineral soil has been exposed.

Within its range, which includes the lower timber or yellow-pine belt on the west slope of the Sierras, from the Kern River on the south to the Pitt River watershed on the north, bear clover is a most important forest weed. While growing in a variety of situations, it does best where the soil is deep and where there is an abundance of sunlight.

TABLE I.—*Summary of results of observations made on the Eldorado and Stanislaus National Forests in 1912*

Character of ground cover.	Density.	Height (inches).	National Forest.	Elevation (feet).	Exposure.	Number of seedlings per acre.	Species by per cent.				Remarks—character of forest, etc.
							I. C.	Y. P.	S. P.	W. F. D. F.	
Bear clover	XXXX	—	Eldorado	4,300	S	0	—	—	—	—	Soil: deep, rich loam. Stand: open virgin YP, oak, and DF. No reproduction except oak sprout.
Bear clover	XXXX	20	Stanislaus	—	NE	0	—	—	—	—	Soil: moderately fresh, deep, decomposed granite. Stand: open YP—IC. Reproduction occurs in openings near plot.
Bear clover	XXXX	—	Eldorado	5,000	S	5	80	—	20	—	Soil: —— Stand: open yellow pine. Oak sprouts also in evidence.
Bear clover	XXX	6–12	Stanislaus	3,300	NW	0	—	—	—	—	Soil: dry, deep, light, gravelly loam. Stand: open YP—IC. No reproduction found.
Bear clover	XXX	16–18	Eldorado	—	W	79	57	13	24	6	Soil: deep red loam. Stand: open SP, YP, WF, and IC. Area shows effects of heavy fires.
Bear clover	XXX	18	Eldorado	4,500	N & E	140	71	6	4	19	Soil: deep loam. Stand: YP, SP, IC, WF, DF, and oak. Area cut over and burned.
Bear clover	XXX	16	Eldorado	4,500	S	337	89	10	—	1	Soil: deep loam. Stand: open YP, scattering IC-WF. Burned butts and snags indicate repeated fires.
Bear clover	XX	—	Eldorado	4,300	S	50	40	20	—	40	Soil: deep rich loam. Stand: open virgin YP, oak and DF. Oak sprouts also in evidence.
Bear clover	XX	12	Stanislaus	3,550	N	107	53	47	—	—	Soil: dry, deep, light, sandy loam. Stand: open YP—IC.
Bear clover	XX	6	Stanislaus	—	N	109	36	64	—	—	Soil: deep, fresh, sandy loam. Stand: open YP—IC.
Bear clover	XX	16–18	Eldorado	—	W	113	18	31	35	16	Soil: deep red loam. Stand: open SP, YP, WF, and IC. Area shows effect of heavy fires.

Bear clover	XX	14	Stanislaus	3,200	W	187	4	96	—	—	Soil: deep, fresh, sandy loam. Stand: Typical open YP—IC. Burned over 9 years before examination.
Bear clover	XX	—	Stanislaus	—	N	3,739	53	46	—	1	Soil: thin, clayey loam. Stand: YP—SP type. Area cut over 7 years previous to examination. Reproduction best where soil was disturbed in logging.
Bear clover	XX	20	Eldorado	4,500	Level	15,997	66	28	5	1	Soil: deep, fresh loam. Stand: typical YP, with some IC, WF, and SP. Very little evidence of fire.
Bear clover	X	16–18	Eldorado	—	W	166	10	31	52	7	Soil: deep, red loam. Stand: open YP, IC, SP, and WF. Area shows effects of heavy fires. Reproduction confined to openings in bear clover.
Bear clover	X	18	Eldorado	4,600	NE	319	4	2	55	39	Soil: deep red loam. Stand: open YP, SP, WF, and IC. Burned butts and snags indicate repeated fires.
Bear clover	X	—	Stanislaus	—	W	409	3	86	11	—	Soil: clayey loam(?). Stand: YP—SP type. Area cut over in trespass some time before examination. 93 per cent of reproduction occurs where mineral soil is exposed.
Bear clover	X	—	Stanislaus	—	N	2,890	20	30	39	11	Soil: clayey loam about ½ foot deep. Stand: YP—SP type. Evidences of recent fires.
Pine needles only			Stanislaus	3,600	N	669	33	67	—	—	Soil: dry, deep, light, sandy loam. Stand: open YP—IC. Area surrounded by dense patches bear clover on all sides.
No bear clover			Stanislaus	—	S	6,069	4	95	1	—	Soil: deep, clayey loam. Stand: YP—SP type. Area cut over two years previous to examination.

Shade appears to be its worst enemy and about the only thing that is able to kill it out. Cattle and sheep will not eat it, and fire only serves to spread it by removing competition, exposing the mineral soil, and stimulating sprouting. In fact, the extensive bear-clover areas today are largely the result of repeated surface fires.

As a fire menace, bear clover is one of the worst types of cover with which the fire-fighter has to deal. While it is not particularly inflammable itself, it burns fiercely, owing to the deep accumulation of litter which it fosters, and fires in it consume the young reproductions in their path and do serious damage to the butts of mature trees. It is only with the greatest difficulty, also, that fires in it can be controlled, the tangle of stems and roots making the building of fire lines through it an exceedingly slow and laborious undertaking.

Bear clover undoubtedly has some value as a ground cover in preventing erosion, but as a conserver of moisture it is a grave question whether the protection offered is not more than offset by the amount of moisture transpired and the amount of precipitation prevented from reaching the ground.

Once established, bear clover has things pretty much its own way, for few species are able to gain a foothold in it, owing to the density of the cover, the depth of the litter it accumulates, the competition for moisture, and the frequency and intensity of the fires that prevail. Of the tree species, incense cedar seems best able to cope with it, and in places where fires have been kept out cedar has been observed to be gradually shading it out. Deer brush (*Ceanothus integerimus*) also has been known to displace it where it had an even start and has been protected from fire and grazing; but without adequate protection, no species, either tree or forage plant, has a show in competition with bear clover.

The results of observations made on the Eldorado and Stanislaus National Forests in 1912 by Forest Examiners George W. Lyons and J. V. Wulff and on 20 sample plots are summarized in Table 1.

While not absolutely conclusive, the figures in Table 1 indicate that in general reproduction on a given site is adversely affected by a ground cover of bear clover; also, that, as stated, the relative percentage of incense-cedar reproduction increases, while the per cent of pine reproduction falls off as the density of the bear-clover cover increases. In the densest stand it will be noted that reproduction of all species has been completely excluded.

Considering the acreage involved, estimated at 18,000 acres on the

Stanislaus National Forest alone, it is evident that bear clover is a serious menace to the natural reproduction of our western slope Sierra pine forests, and that sooner or later something will have to be done about it. Considering the nature of the plant, adequate fire protection is unquestionably the first and most essential step. While this alone will ultimately reduce the unstocked acreage materially, there will probably still remain considerable areas on which artificial reforestation will have to be resorted to. This presents a problem yet to be solved, as past efforts in this direction have proved generally unsuccessful, particularly where broadcast and seed-spot sowing has been tried. Even where furrows were plowed and the seed sown in the mineral soil laid bare, the results were not particularly encouraging, as the bear clover soon spread over the furrows and choked out the pine seedlings that did manage to become established. Better success with nursery stock is to be hoped for; but the aggressive root competition of the bear clover will have to be reckoned with and some means devised to counteract it.

STATE FOREST NOTES AND LEGISLATION

MISSISSIPPI

A forestry bill introduced in the legislature failed of passage. It authorized the establishment of a board of forestry and the appointment of a State forester, and provided for a system of forest protection, management, and replacement, and for a State forestry fund by levying a license tax on the amount of timber cut. In proposing to secure funds from a license tax, the Louisiana plan was followed.

NEW JERSEY

Special Effort to Prevent Fires Escaping from Brush Burnings

A small hand-bill poster calling attention to the requirements of the permit law, which allows no building of fires within 200 feet of the woods or of any ground cover that may carry fire to the woods, has been issued. The intention is for firewardens, patrolmen, and similar officers of the Forest Fire Service to post one or more of these posters on every site where there is any reason to believe burning will shortly be done because of brush that has been cut or of new clearing that is going on. It has been found to be so emphatically true that if residents secure permits they are far more careful than when they do not that this effort, presumably, will cut down the number of fires from brush burnings, in addition to preventing the large number of violations of the permit clause because of ignorance of the law. Since the fires that start from brush burnings are from 10 to 20 per cent of the total fires in the State annually, a special effort is being made to curtail this difficulty.

Special Privilege to the Military

The large concentration of men at Camp Dix, in New Jersey, which is located on the edge of one of the worst wilderness sections of the South Jersey pines, presented an unusual problem from the forest-fire standpoint. By an understanding with the authorities in command, special emphasis is being laid upon the need for care with fire when the men at the camp have occasion to go into the wooded sections for either recreation or official work. The department has made a blanket waiver of the necessity for securing permits for building fires to all

military parties who are out on official duty in the various sections adjoining the cantonment.

KENTUCKY

The consolidation of the State Board of Forestry and the Geological Survey was brought about at the 1918 session of the General Assembly. Early in the session strong opposition developed to what were termed boards and commissions. This opposition grew throughout the session and finally took concrete form in a series of bills prepared by an investigating committee, which proposed sweeping changes involving abolishments and consolidations. Among the proposed changes was the consolidation of the Board of Forestry and the Geological Survey. This was finally brought about with the following noticeable features:

1. The Board of Forestry and the Geological Survey were abolished.
2. A Commissioner of Forestry and Geology was substituted, appointive by the Governor, and a deputy was also provided for. If the commissioner was a graduate forester the deputy should be a graduate geologist and *vice versa*.
3. The appropriation of the Board of Forestry was repealed and the appropriation of the Geological Survey continued for the new department, and in addition the salaries of the commissioner and the deputy are paid directly out of the treasury and not out of the appropriation.
4. The method of procedure and the character of work of the two departments was left unchanged.

It is not expected at the present time that the personnel of the two departments as they heretofore existed will be interfered with. The Governor appointed J. E. Barton, formerly State forester, as Commissioner of Geology and Forestry, effective July 1. This appointment is for two years. Subsequent appointments run for four years.

NORTH CAROLINA

Fire Protection

The departure in fire protection has been made of employing the patrolmen to cover much larger districts than heretofore. Whole counties, or even still larger areas, are now given to one man, who is expected to post notices all over his district, interview sawmill men, farmers, and other residents, distribute leaflets, and explain the forest-fire law. They devote much more time to educational work and less time to actual fire patrol than the men previously appointed, who had smaller districts. It is thought that the educational work done by

these men will much more than compensate for their inability to deal fully with actual fire extinguishment.

Mitchell State Park

The administration of this park, which includes the summit of Mt. Mitchell, the highest peak in the eastern United States, has been turned over to the State forester. One of the chief objects of the creation of this park was to save for the people of the State a small area of spruce forest, which reaches its southern limit on the highest mountains in North Carolina. These spruce forests, which were practically untouched 15 years ago, are now nearly all destroyed by lumbering followed by fire. Last spring fire from an adjoining lumbering operation entered the park and destroyed 15 acres of the best timber. The sale of the burned timber, however, has produced a fund which is being used for the construction of fire lines, the improvement of trails, and the general administrative expenses of the park. A scenic railroad carries thousands of visitors to within a mile of the summit of Mt. Mitchell, and one of the chief problems is to protect the young trees, shrubs, and flowers from the despoiling visitors.

Farm Forestry

The State has secured a farm forestry specialist as an expert in the Division of Extension of the Federal States Relations Service, to work under the joint direction of the State Director of Extension, the State forester, and the U. S. Forest Service. Already examinations have been made for a large number of farmers who wish to sell the products of their woodlands to the best advantage or who are interested in their better management. North Carolina is the first State to secure the services of a farm forestry specialist in this capacity, although farm forestry has been specialized in by some of the State forestry departments.

REVIEWS

Influence of Forests upon the Melting of Snow in the Cascade Range. By Alfred A. Griffin. Reprinted from Monthly Weather Review, July, 1918, 46, pp. 324-327, 3 figures, 4 tables. (Dated Portland, Oregon, April, 1918.)

Up until very recently American foresters have been compelled to turn wholly to European investigators for data relating to the influence of forests upon the melting of snow, but during the last five years several papers have appeared dealing with American conditions which are beginning to make us more independent of these Old World sources. Fernow's excellent review[1] of meteorological observations in Europe shows that snow is held longer and more continuously in forests, and that the melting of snow is retarded by from five to eight days (in Switzerland) and very often as long as several weeks. Pearson,[2] in a meteorogical study of western yellow pine forests in Arizona and New Mexico, carried out from 1909 to 1912, found that snow fell more evenly and accumulated to a slightly greater depth in the park than in the forest in the winter time, but that it remained on the ground from two to three weeks later in the forest, and that a greater portion of the snow waters was absorbed by the soil in the forest than in the park. Jaenicke and Foerster,[3] working in the same type of forest in Arizona, from 1910 to 1913, found that heavy drifts of snow persisted in the forest for two or more weeks after the total disappearance of the snow in the open parks. The present study deals with an entirely different part of the country, namely, the Columbia River watershed in Oregon and Washington. In the forests of this region it was found that snow remains an average of 17 days longer in the forest than in the open. Thus, again, are the results of both American and European investigators corroborated upon this important subject.

Members of the United States Forest Service carried out these

[1] Fernow, B. E.: Forest Influences. Forestry Division, Bulletin No. 7, pp. 20, 137, 152. Washington, D. C., 1893.

[2] Pearson, G. A.: A Meteorological Study of Parks and Timbered Areas in the Western Yellow Pine Forests of Arizona and New Mexico. Monthly Weather Review, 41, pp. 1615-1629, 1913.

[3] Jaenicke, A. J., and Forester, M. H.: The Influence of a Western Yellow Pine Forest on the Accumulation and Melting of Snow. Monthly Weather Review, March, 1915, 43, pp. 115-126, 9 figures and 23 tables.

studies on three separate areas—in central Oregon, in southern Washington, and in central Washington. Messrs. Sproat, Kraebel, Kloe, Ramsdell, Hellen, and Griffin took the observations and A. A. Griffin compiled the data. On each area the depth, density, and distribution of the snow throughout the melting season at from 8 to 20 typical observation points or stations were observed during the seasons 1916 and 1917. These stations were well distributed, altitudinally, from a minimum of 1,200 feet to a maximum of 6,800 feet. The forests consisted largely of Douglas fir, hemlock, true firs, and western pines, and the density of the stand, although somewhat variable, ranged between 0.45 to 0.8. The three areas were located upon important tributaries of the Columbia River, and each watershed was important and valuable on account of the irrigation water which it furnished. The stations were located in the open and in the forest in pairs, being similar in all respects except forest cover. Careful notes were taken, especially upon aspect, degree of slope, and distance to trees, stumps, edge of timber, and upon the possibilities of drifting. Snow depths were measured at regular intervals of a week or less, from the period of greatest depth, throughout the melting season. The season varied from 9 to 17 weeks. Permanent graduated stakes were used. Snow density or water equivalent was measured at each regular observation by means of standard U. S. Weather Bureau apparatus and by means of sampling cans.

The results of the observations show very clearly that there was more snow in the open than in the forest when the observations began (in early April), but that in spite of this there was still considerable snow left in the forest after the snow had disappeared from all the open stations (in July). Thus, on the Tumalo area, in central Oregon, no snow was left on July 18, 1916, on any of the stations in the open, while the forest stations showed an average of 19.3 inches of snow, equivalent to 8.7 surface inches of water. On the Wind River area, in southern Washington, 28.2 inches of snow remained at the forested stations as the corresponding open stations became bare. On the Yakima area, in central Washington, 19 inches remained after the corresponding open stations became bare. Thus, on the average, the forest areas conserved 7.5 surface inches of water through a period of from 17 to 42 days—a factor which is of vital importance from an irrigation viewpoint.

The influence of forests upon the melting of snow was correlated with site factors; but, due to insufficient data, most of the relations

one might expect to find did not materialize. One result, however, on this point worthy of note is the fact that the conservation of snow, both on the basis of quantity and duration, was shown very clearly to vary directly with the density of the forest. For instance, a forest with a density of 0.49 conserved 4.4 inches of snow for two weeks, while a forest with a density of 0.77 conserved 27.8 inches of snow over a period of four weeks. These figures are, of course, averages for a larger number of stations of approximately equal density.

On the whole, the study seems to have been very carefully planned and carried out, and it is a very welcome addition to our meager knowledge of the subject. The men who carried out the instrumentation are to be commended for their perseverance and tenacity, for doubtless they encountered many difficulties in taking these observations. The reviewer spent the greater part of one winter taking similar observations on Pikes Peak and can appreciate the hardships and physical difficulties often encountered in work of this nature. One important criticism which we cannot help bringing to the reader's notice is the short period over which the study was carried out. A certain class of scientists, who sometimes like to willfully distort things, or at best throw huge obstacles in the way of the forester who is working on forest influences, may easily raise the objection that the results are based upon too meager data and may easily be accounted for either on the basis of wholly accidental differences in local distribution of precipitation or on the basis of residual and uneliminated errors of measurement, which are known to be very large for snow. We do not mean to say that the reviewer would take this attitude, but professional meteorologists might. Therefore studies of this nature should, in order to clear away all intentional or unintentional doubt, be based upon many years of observations.

Also, it seems that the results here tabulated are a little too much abbreviated. We should like to know, for example, how the density of the forest was measured; also, perhaps some notes upon the condition of the soil at different periods, as regards to the depth of frost in the forest and in the open. The latter would have an important bearing upon percolation and surface run-off and thus be applicable in irrigation.

We are glad, however, to note the application of the results obtained to the irrigation problem, so important upon the areas tributary to these watersheds. Expressed in irrigation terms, the figures mean that on areas studied the average square mile of forest land retained

the average equivalent of 400 acre-feet of water in the form of snow after the open areas had become bare, or sufficient to irrigate about 650 acres for one month during the summer low-water period. The author therefore concludes that the forest is a very important and very valuable factor in increasing the water available for irrigation.

It would be interesting to have a more detailed explanation of just how the retarded melting of the snow would benefit irrigation. While a difficult matter to prove experimentally, we would hazard this suggestion: the retardation of the melting of the snow gave a longer time for infiltration to the subsoil, which, being less deeply frozen, was more apt to be open for subterranean drainage than open land. Open land is more apt to become incrusted with an impermeable surface stratum which turns the melting snow waters into surface drainage. This resulting increase of subterranean drainage is the important factor for irrigation. The snow which fell during the winter and melted in the spring is thus preserved for the water table, to reappear in the summer when there is danger of water shortage.

In conclusion we would say that we would like to see more work like this. Certainly the present set of data should be amplified by future observations upon the same area; also, data upon other sections of the country would be welcome. No doubt the Forest Service files contain much valuable data upon this and similar problems which is doing nobody any good. Not only must such data be published for the perusal of foresters, engineers, and scientists in general, but, what is more important, it should be brought to the attention of the public, who is paying for the maintenance of our National Forests. Apropos of the present study, we would suggest that the results, especially as they are related to the irrigation problems of the region studied, be made public in the Seattle, Portland, Tacoma, and Spokane press.

R. H. D. B.

The Foundations of National Prosperity. By Richard T. Ely, Ralph H. Hess, Charles K. Leith, and Thomas Nixon Carver. New York: The Macmillan Co., 1917.

Misery is not the only thing that makes strange bed-fellows. This volume assembles four papers, originally presented before the Second Pan-American Scientific Congress. Of their four authors, three are professors of political economy, the fourth a professor of geology. The theme is in each case some aspect of conservation. A preface is supplied by Professor Ely, who also contributes the paper entitled

"Conservation and Economic Theory." In the preface we are told: "It occurred to the editor that these four papers supplemented each other and, if properly expanded, would make a harmonious whole." The expansion, however, though moderate, is more in evidence than the harmony. It is chiefly because of the bookbinder's art that they form a volume.

The first three papers, it is true, do treat, though with uneven merit, of what constituted the conservation movement. In the fourth paper Professor Carver takes for his title the "Conservation of Human Resources." As always, he is delightfully lucid, entertaining, and at his ease. He writes with obvious enjoyment, not to say joyousness; had economics always been dealt with in this manner, it could never have been called the dismal science. He writes also with a sort of careless freedom from the trammels which a conventional treatment of his subject-matter would naturally have imposed. It is the unexpected and the overlooked which particularly attract him. He is like a good dinner guest, giving us table talk that is keen, discriminating, humorous, and challenging. Not that he trifles with his subject; he is amply grounded in it, though he bears his learning lightly; but he handles it with a zest akin to playfulness and with a cultivated casualness of method that leaves no suspicion of an attempt at systematic presentation of his thought. Hence the reader can count on much entertainment as he turns the pages in which Professor Carver expounds essentially orthodox economic dogma, though sugar-coated, in discoursing of wastes of human energy; of idleness, ignorance, dishonesty, and vice; of wise and unwise investors and our urgent social need of wise ones; of "rational consumption"; and so to his "conclusion," which is perhaps as appropriate here as it would be anywhere else. It is a chapter of two paragraphs, characteristically summarized by the author under the headings "Why it is better to tell the truth than to tell lies" (though the paragraph concerns mainly the social desirability of having private property secure and the pros and cons of inherited wealth) and "Various types of nation-builders."

Thus the real issues of conservation—the social causes of poverty, disease, crime, and the means available for their amelioration—are passed over. We need not quarrel with Professor Carver for having done this, especially since he gave us fair warning, in the third sentence of his introduction, that it was his purpose "to present some phases of the problem which are commonly overlooked in current treatises rather than to cover the whole field." None the less, such a treat-

ment indubitably leaves something to be desired if the purpose of the volume is supposed to be a serious attempt to inform the general reader as to the real issues raised by the conservation movement.

Of the seriousness with which Professor Ely handles his special topic, entitled "Conservation and Economic Theory," there can be no question whatever. Yet it is difficult to take the paper itself as seriously as the reputation of its author would make one wish to do. Unfortunately, in this case, Professor Ely seems, after all, to have had little of importance to say. Of this, it is true, he himself was apparently unconscious. Barren definitions, classifications which get nowhere, and solemn platitudes delivered as though they were the sum and substance of human wisdom, weary the reader to no profit. To enumerate in detail the shortcomings of this venture into a field in which it is as necessary as it is charitable to assume that the author strayed without adequate preparation would take more space than can here be given. For those who have any knowledge whatever of the history of the conservation movement, the value and accuracy of the paper will be sufficiently characterized by allowing it to speak for itself.

Chapters II, III, and IV give a kind of historical review of the development of the conservation movement. According to Professor Ely, "it was the work of economists in preparing the public mind throughout the length and breadth of the land that helped to make possible the later work of the conservationists." Modesty does not prevent Professor Ely from claiming for his own "early treatises, beginning with the *Introduction to Political Economy*, published in 1889," a considerable share of the credit. "Forestry was discussed"—in two pages, a footnote informs us—while the State was "presented as a guardian of the permanent interests of society." This view of the State "is the corner-stone of wise conservation policies—a very *sine qua non*. Now this book was prepared for the Chautauqua reading course, elsewhere. And Chautauqua was then able to take the message to every part of our broad land."

Dr. Fernow is given a place of deserved prominence in this historical review, but principally, it would appear, because of his lectures and writings on the economics of forestry. His name first appears on page 15, where we are informed that "in 1891 the American Economic Association showed its appreciation of one of the more important aspects of conservation by publishing a monograph on forestry consisting of three papers—one by Mr. Gifford Pinchot, on 'Forestry

Abroad'; one by Mr. Edward A. Bowers, on 'The Present Conditions of Forests in the Public Lands'; and the third by Mr. B. E. Fernow, on 'The Practicability of an American Forest Administration.'" It is possibly a cavil to call attention to the fact that only in this passage do the first and third of these names appear without the title of "Dr."; but accuracy in details is no more a shining virtue of Professor Ely's present "study" than is its sense of proportion and perspective. The next mention of Dr. Fernow's name is due to the fact that in 1896 he "gave a course of lectures on the economic aspects of forestry, under the auspices of the Department of Political Economy, in the University of Wisconsin." The passage thus introduced occupies nearly a full page. A little later a quotation is introduced as from "Dr. Fernow's address of 1886." The original may be found both in Dr. Fernow's "Economics of Forestry," published in 1902, and in an address delivered in August, 1895, before the American Association for the Advancement of Science. On page 21 we are told that "the Forest Service was created February 1, 1908." This misstatement is immediately followed by the sentence: "Nor should we neglect to mention the work of Dr. Gifford Pinchot, which has been epoch-making in conservation." This is all that Professor Ely has to say regarding Mr. Pinchot. Except for a footnote of no importance, Mr. Pinchot's name appears only in the somewhat equivocal statement that "if the economists helped prepare the way, we may say that, under the leadership of President Roosevelt and such men as President Van Hise and Gifford Pinchot, the public first became conscious of the real import of conservation policies."

It is impossible to ascribe solely to ignorance the grudging character of Professor Ely's appraisal of the work of the true leaders in the great movement of which President Van Hise has said that "among the men who have promoted the modern conservation movement, Gifford Pinchot has first place." And again, "Gifford Pinchot, generally recognized as the most potent force underlying the conservation movement."

Of pure ignorance, it is true, there is ample evidence. Professor Ely simply did not take the trouble to qualify himself sufficiently by adequate study of the documents for the task to which he put his hand. If he ever heard of Professor Marsh's book, "The Earth as Modified by Human Action," by far the most notable American early contribution to what eventually became the conservation movement, the text before us gives no sign of the fact. The volume is innocent of a bib-

liography. It may be that the egregious slip embodied in the statement which is fathered upon Mr. Pinchot in the footnote on page 11, that "the name (conservation) was devised in the United States in 1898," is one for which Professor Ely is not primarily responsible; but careful proof-reading by any one really familiar with the history of conservation should have caught up the error. More significant, however, because suggestive not merely of superficial knowledge, but also of deliberate unwillingness to give credit where credit is richly due, is the reference to the work and writings of Dr. W J McGee.

Adequate statement of Dr. McGee's contributions to the conservation movement would necessitate nothing short of a full history of that movement. In a sense, his share in it was the crowning accomplishment of his full, varied, and immensely productive life. A record of that life, from the standpoint of its scientific and public-welfare activities, is embodied in a recent publication of the Washington Academy of Sciences, entitled "The McGee Memorial Meeting." This meeting was held in Washington, at the Carnegie Institution, December 5, 1913. The bibliographies incorporated in the published record of this meeting fill nine pages with titles of Dr. McGee's writings. An authoritative statement from the man better able than any other living being to appraise the importance of Dr. McGee's work for conservation was made at this meeting by Mr. Pinchot. In this statement he said:

"Without McGee the conservation movement would either have been delayed for years or would have been halting and feeble at birth. His contribution to it has been too little known. . . . Many and many a passage in Roosevelt's presidential messages and in other State papers dealing with conservation had its first beginning in McGee's penetrating intelligence. . . . . So far as such a thing can ever be said of any one man in a movement so extensive, McGee was the scientific brains of the conservation movement all through its early critical stages. The distinguishing character of that movement from the first was its joint consideration of all the natural resources together as the working capital of humanity. . . . The wide and balanced knowledge of this continent which was so striking a peculiarity of McGee's intellectual equipment naturally fitted him for this work in a very high degree. . . . McGee at least as much as any other one man was responsible for formulating the plan for the Roosevelt Inland Waterways Commission, which for the first time in any national project considered as a single problem the wise handling of all the natural resources of the continent. As secretary of this commission and as unofficial adviser and guide of all of the inland waterways associations, McGee played a part in the development of our rivers the importance of which it would be difficult to overstate. Of all his services to the conservation movement, this was the

one. . . . in which his contributions were most effective. . . . His relation to the National Irrigation Congress during the latter years of his life was hardly less decisive. . . . He was one of the two men upon whom rested the arrangements for the great Conference of Governors held at the White House in May, 1908. Many of the utterances which attracted most attention at that conference were prepared by him or with his assistance. . . . Out of the Conference of Governors grew the National Conservation Commission. Officially McGee was merely secretary of one of its four divisions, that which dealt with the waters of the continent. Practically, in every branch of the Commission's work he was the trusted and effective adviser, a very fountain of knowledge, without whom the material for its historical report, the first inventory of the natural resources of any nation, could not have been brought together."

Of this man Professor Ely merely says in his text:

"Dr. W. J. (*sic*) McGee's name is one which must not be entirely omitted."[1]

He appends this footnote:

"W. J. McGee—anthropologist, geologist, and hydrologist (1853-1912), was the author of *The Agricultural Duty of Water,* 1911, but probably is chiefly to be remembered with conservation as the recording secretary of the Conference of Governors referred to above."

It is not for the purpose of vindicating Dr. McGee's rightful claims to recognition as one of the foremost figures in the conservation movement that the slighting mention made of him is brought out. His reputation needs no vindicating in the JOURNAL OF FORESTRY. What we are concerned with now is the apparent bias displayed by Professor Ely, and the reasons for it. Other passages than those already quoted show, though guardedly, the same spirit. Reference is made, for example, to "the indiscretions, exaggerations, and other mistakes of certain conservationists whose wisdom was not equal to their zeal." Evidently Professor Ely wishes to have it understood that he is a safe-and-sane, middle-of-the-road conservationist. He is no wild-eyed bolshevist, but a student of economics applying in the alembic of his mind the acid test of logic and sound method to loose conceptions and half-baked proposals.

Along with this must be taken into account that he starts out with a thesis to maintain. In his view, the scientists have had a disproportionate prominence in conservation matters. When we reflect seriously on the subject, he tells us, we see that we have here to do with

[1] Dr. McGee invariably wrote and printed his name without periods after the two initials.

two orders of inquiry. One of them falls within the broad field of the natural sciences; the other is economic in nature and is concerned with property relations. Geologists, agricultural scientists, and foresters must instruct us, in their respective fields, concerning the nature and extent of our natural resources and methods of putting them to use; but "it is in the property relations most suitable for conservation that the greatest difficulty arises, and it is on this account that the chief rôle in conservation belongs to the political economists, who must cultivate more diligently than heretofore that part of their field which we must designate as economic jurisprudence." The scientists have run away with the topic and most of the glory, and have come near to upsetting the applecart; but long before their appearance on the scene the economists had perceived the fundamental issues and had laid the groundwork for the new point of view regarding the relationship between the public welfare and the rights of private property.

Thus our Wisconsin economist discloses a twofold purpose: The first and less important is to establish the historical importance of the work of economists as leaders in the conservation movement. In this he does not succeed. Only by a complete distortion of the history of the movement does he make out even a *prima facie* case. The greater part of his paper, however, consists of an attempt to demonstrate the practical value of economic thought as a means of solving the vexed questions to which the conservation movement has given rise.

The demonstration, it must be said, is highly disappointing. It is true that property relations and the rights of the public in the maintenance or the wise use, from the standpoint of the general welfare, of our natural resources lie at the very heart of conservation. But it was not by applying the principles of political economy to the facts that the course which should be followed was to be determined. The essence of the matter lay not in what the economist can show is true, but in what you are going to do about it. In other words, the true problems involved were problems of statesmanship. If proofs of this fact were wanted, the book before us amply provides it. As economists, its authors can only go a certain distance in telling us what is expedient. Beyond that point they can only say that the way is uncertain. You may or may not get through. You will have many risks to run. There is this danger on one side and that on the other. But the statesman cannot wait for the uncertainties of the future to become the certainties of the past before he moves forward. The conservation movement affords much for economists to write about, but a poor

opportunity for them to claim a right to the chief rôle in the shaping of public policies.

It is significant that of the four papers which make up "The Foundations of National Prosperity," Professor Leith's is the only one which is particularly informative on concrete conservation issues; and Professor Leith is not a political economist, but an economic geologist. His paper, entitled "Conservation of Certain Mineral Resources," deals specifically with coal, iron, and copper, which are regarded as illustrative. The essence of the matter, if not its sum and substance, is the husbanding of these and similar non-renewable resources, mainly by reducing waste. Private enterprise and the natural play of economic forces are working strongly in this direction. The most promising field for the use of the powers of government to the same end is that of co-operative, not antagonistic, activities. From private monopoly there is little to fear, since the reserves are too great to be successfully controlled. Greater concentration of control and greater freedom to enter into combinations, accompanied by public regulation of a reasonable, not to say benevolent, character, would have its advantages. The high standards of conservation which happily already characterize large-scale production, as a rule, might be made compulsory upon the weaker competitors of big business. Along these lines does Professor Leith advance to the statement of his final position, that there is plenty of room for conservation that won't hurt any existing private interest, while it will be a long time before we shall know enough to have much prospect of success with any other kind.

The second of the four contributors to Professor Ely's book has so far gone unmentioned—Professor Ralph H. Hess, who writes on "Conservation and Economic Evolution." The appraisal of the value of his discussion of underlying economic theories may perhaps best be left to those whose primary interest is with abstruse conceptions rather than with concrete questions of practice and policy; for it is more than time to point out what the conservation movement really was and sought, in contrast with what the reader of these conservative essays might suppose.

Conservation is a word of many uses. Its present vogue was gained as the result of a great public awakening to the need of a new attitude toward our natural resources. Those who initiated and led this movement knew very definitely what they were after and what kind of a fight they were in for; but it was good strategy to mask the attack on the citadels of privilege while the crusade was gathering momentum and to join battle on new ground. "One of the beauties of calling this

the conservation movement," Gifford Pinchot used to say, "is that nobody can reasonably say he is against conserving our resources." In its initial stages conservation swept the country. The idea behind the word was applied in a steadily broadening field, and a multitude of causes hastened to inscribe on their banners the new motto and to array their forces with the gathering hosts. It was neither expected nor desired that conservation should be as a shibboleth, to distinguish the true believers from their real opponents. To say that it became all things to all men would be nearer the truth. The present volume illustrates the fact that, after ten years of warfare over the conservation issues, the word had an ambiguous significance even before Messrs. Hoover and Garfield had seized it to consecrate saving at the breakfast table, heatless Mondays, gasless Sundays, and lightless nights for the winning of the war.

The ambiguity arises from the fact that the essence of the idea commonly supposed to be denoted by the word is waste. When the history of the United States from the opening of the twentieth century to the opening of the war with Germany comes to be written, it will be found that a truer denotation is monopoly. Conservation challenged the right of capital to control the development of the country in its own interest. It did so on the ground that important interests of the public were being sacrificed, and that it was both right and necessary for the nation to protect the interests of the public. The arch-foe which it attacked was not unthrift, but big business; but the bill of indictment which it brought against big business was on the grounds both novel and practical. Big business was already under indictment at the bar of public opinion on many charges—that it owned the Government, made the laws, ran the courts; crushed or stifled competition; oppressed the wage-earner; concentrated wealth; promoted inequality; sapped the foundations of American democracy and its ideals of individual freedom, economic independence, reasonable comfort, and equal opportunity for all. The answers to these indictments were mostly in the form of a confession and avoidance. If social injustice resulted from the operations of big business, the fault lay not with big business, but was inherent in the nature of things, unless you wished to make things worse by prohibiting efficiency. Big business made for economy, thrift, the increase of wealth, and hence in the long run for the best interests of all concerned. But the conservationists—that is, the real ones—cried, "No."

The goal of conservation was more than the prevention of waste, the safeguarding of resources against unnecessary impairment or destruc-

tion, and the increase of their capacity to serve human needs. Its primary concern was not economic, but social betterment. From start to finish, it was an assertion of the public interest in such a handling of the sources of wealth as would result in the greatest good to the greatest number. It sought not merely more prosperity and continued prosperity, but diffused prosperity. This greater part of the whole matter is all but omitted in the present volume save for Professor Ely's side-heading "Justice in Distribution," a misleading label because, as conservation was conceived of and presented to the nation in the Roosevelt days, this old sentimental battle-ground was avoided. Instead there was substituted a new, intellectual conception—the necessity for better conditions for the sake of national efficiency. P. W.

Climate and Plant Growth in Certain Vegetative Associations. By Arthur W. Sampson. Bulletin No. 700, U. S. Department of Agriculture. Forest Service, October 1918. 72 pages.

Ecologists have been keenly alive to the importance of serious research to determine the relation of climate to the growth and development of vegetation. Sampson, in the bulletin under review, places emphasis on the climatic requirements of various plant types as largely responsible for the results obtained in experimental seeding and in forest planting. He believes that, when once the adverse climatic factors are known, failures may be largely avoided by the judicious selection of sites or of species especially adapted to withstand the limiting factors. The reviewer agrees that a perfect interpretation of the divers site factors with reference to growth and development in different plant forms is much to be desired, but the problem is a difficult one and a long way from satisfactory solution. The author, by planning and carrying out an extensive series of experiments at the forest research station in central Utah, has added not a little to the rapidly accumulating data on site factors and vegetation. The work was planned, first, to obtain a comparison of the climatic requirements of the main plant types of the region, and, second, to determine quantitatively the relation between various environmental factors on the one hand and plant growth and certain other physiological functions on the other. The experiments were conducted over a period of two years and in the following vegetative types: oak-brush, aspen-fir, and spruce-fir. The investigations were chiefly concerned with recording and summarizing the meteorological data and in determining the relation of certain weather factors to growth, water requirements, and certain other phys-

iological functions of standard plants developed under different climatic conditions.

The plants experimented with under the different types of climate and in different kinds of soil were peas, wheat, and brome-grass, all of which were grown in suitable potometers. Water was added in measured amounts, as needed, to keep the soil from drying to a point approaching closely its wilting coefficient.

The measurement of the plants grown in the battery of potometers, at each of the different stations representing the three climatic types, included the measurements of the stems and leaves at regular intervals throughout the growing season, in order to obtain data on the relation of the environment to the tendency of the plants to elongate their stems and to expand their leaves; also, at the end of the growing season, the dry weight and ash content of the parts above ground were determined, and in some instances the soil was washed from the roots and the dry weight and ash content also determined. In these measurements full consideration is given to possible sources of experimental error.

The measurement of the physical factors at each of the type stations where batteries of potometers were located included continuous records of air temperature, precipitation, evaporation, relative humidity, sunshine, and barometric pressure. A continuous record of wind velocity was kept at the upper and lower stations.

It is well known that the values obtained in the measurements of the physical site factors depend largely upon the kind and character of the instruments used. The author emphasizes this point and presents a comparison of evaporation data derived from a free-water surface and from the porous cup atmometer of various types. In order to obtain an evaporation record comparable with transpiration from the plant for short periods, the instrument with which the evaporation is measured should correspond quickly with temperature changes in the air, as does the plant itself. The author found the atmometer superior to the free-water surface employed, due to its quicker response to temperature changes.

The data on sunshine intensity were obtained by noting the difference in evaporation between the radio-atmometer and the ordinary white porous cup atmometer. The duration of sunshine was measured with the Marvin sunshine recorder. The difference in the rate of evaporation from the black and white porous cup atmometers is not only a measure of sunshine intensity, but it was found to be a fairly good index of sunshine duration. There was but little variation in the slope of the curves of evaporation from the two atmometers except on cloudy

days, and the data seemed to warrant the statement that the use of atmometers to obtain records of sunshine duration are quite as reliable as the more costly sunshine recorder.

The author presents a detailed comparison of the climatic characteristics of the sites where the potometers were located and summarizes them on different bases. It is a comparatively easy matter to measure the growth of plants and to measure the separate site factors to which they are subjected. The difficulty comes in correlating growth with these factors. The most interesting, but also in many respects the most unsatisfactory, part of the bulletin is the attempt on the part of the author to correlate growth with the environmental factors. An analysis is made, first, of the relative development of the plants at each station and their corresponding water requirement; second, of the relative development of the plants at each station and the amount of available heat; third, the effect of evaporation and temperature on the production of dry matter and on the growth of the plant as a whole.

The temperature factor in the respective stations for the periods that the potometers were under observation was summarized as follows:

(*a*) By physiological temperature coefficient.

(*b*) By the sum of the means above 40° F.

(*c*) By the sum of the daily means.

It is worthy of note that the summed physiological temperature coefficients derived by Lehenbauer's method bore practically the same relation to each other in the respective type stations as the sums of the means above 40° F. This relation, however, did not hold true in the summation of the daily mean temperatures.

The summation of water requirements in the respective stations was based upon the water required to produce during the growing season a unit weight of dry tops of the standard plants. The most striking features brought out in the graphs, representing the summation of water requirements, were the greater vegetation development per unit of water consumed in the aspen-fir type and the relatively high water requirement for the production of a unit of dry matter in the oak-brush type.

In order to determine the relation of the water requirements of the standard plants to evaporation and temperature in the type stations, the water used per unit of dry matter through practically the entire growing season was in each case divided by the evaporation for the corresponding period. The value of the quotients obtained was found to be highest in the oak-brush type, intermediate in the aspen-fir type, and lowest in the spruce-fir type, and the conclusion was reached that

the water requirements of the standard plants are largely a matter of evaporation and temperature. Hence agricultural and forest plants grown in the localities of least rainfall, highest evaporation, and highest temperature should be confined to soils of high water-holding capacity and subject to minimum run-off, so that the soil may provide them a high percentage of the rainfall.

Evaporation appeared to be the chief factor in limiting the growth and development of plants in the oak-brush and spruce-fir types. Consequently, the extension of agriculture and forestry in these associations should be limited to lands protected from excessive evaporation. This can be done by selecting sites more or less protected by native vegetation and natural obstacles. The opinion is expressed that failures from forest planting in the middle or aspen-fir type are seldom caused by adverse climatic conditions, but by preventable causes. Although the bulletin contains a fund of information for students of site factors and their correlation with the resulting vegetation, it brings us no nearer to an acceptable method of relating forest vegetation to the complex of physical factors which constitute the environment.

J. W. T.

The Preservation of Wood. By A. J. Wallis-Tayler. Wm. Rider & Son, Ltd., London, 1917(?). Pp. 344.

As is so commonly the case with books of this class published in Great Britain, this book is not dated. It may therefore be sold for an indefinite period as the latest work on the subject of wood preservation. Mr. A. J. Wallis-Tayler, who has written similar books on subjects ranging from Diesel engines to tea factories, delivered a paper on the preservation of wood, before the Royal Society of Arts, on the 18th of February, 1914. According to the author's preface, this book is based upon that paper. This is at the outset rather unfortunate, as at that time Mr. Wallis-Tayler labored under the impression that the decay of wood begins with the fermentation of the sap, caused by bacteria. In this book we consequently note that "putrefactive fermentation and the subsequent decomposition of vegetable matter is due to albumen," and also that "the most common causes of decay of wood are the presence of sap and being subjected to alternating conditions of wetness and dryness, or to a combination of moisture, heat, and the absence of ventilation," which should be rather instructive information to foresters and others who are working in the field of forest pathology. Decay is classified as *"wet rot and dry or sap rot,"* and the chapter on this sub-

ject is a curious mixture of citations from modern and ancient authorities. The illustrations of fruiting bodies of fungi, on pages 23 and 24, copied from Plate II of Bulletin No. 41 of the old U. S. Bureau of Forestry, are credited to R. Wade & Sons, Ltd., of London.

Unlike other untechnical writers of technical literature bearing on the utilization of wood, Wallis-Tayler has had the courage to condense the inevitable list of important woods, which are presented only in a tabulated form, thereby saving considerable room on many library shelves. The chapter on kiln-drying shows an almost startling lack of information on the development of this work in America. His reference to Tiemann's "Strength and Stiffness of Wood as Influenced by Moisture" is confined to a citation from a review which appeared in the Engineering and Mining Journal of November 10, 1906.

The theory of the penetrance of preservatives is rather cleverly handled by long extracts from articles by Bailey and Tiemann, thus giving a good summary of the work that has been done on this subject without introducing errors due to the very evident lack of familiarity on the part of the author with the structure of wood, as will be noted in the following quotation, taken at random: "The vessels *or* tracheids form the lungs of the plant, and in these vessels is the sap, the circulation of which through the tree is the source of its existence." Whether the illustration of a magnified section of beech wood on page 112, which is of German origin, is a subtle attack upon the over-advertised technical prowess of the Germans, is a matter that may give rise to some interesting speculation. If it was chosen for that purpose, it shows that the author possesses a rare sense of humor.

The chapters on the apparatus used in wood preservation are reasonably good compilations from booklets of various machinery manufacturers and the proceedings of the American Wood Preservers' Association. The chapters on preservative processes show an evident lack of familiarity with every-day problems that are encountered in the operation of wood preserving plants. Proprietary wood preservatives are given full attention, but their limitations are not discussed. The book closes with chapters on the fireproofing of wood, the cost of preservative treatment, and tables, formulæ, etc. B. L. G.

Annual Reports of the Massachusetts State Forester for 1915, 1916, and 1917. Boston, Mass. Pp. 130, 124, and 99.

By some unaccounted delay the twelfth, thirteenth, and fourteenth reports of the Massachusetts State Forester have reached us at the

same time. We regret this delay in receiving the earlier reports, the more as they contain much interesting information; at the same time by reviewing them together a fuller insight into the state of affairs is gained.

There is a personal note and enthusiastic optimism and self-satisfaction pervading these reports which is refreshing and apparently justified, but still provokes a smile by its exuberance. To quote: "We undoubtedly have the best forest-fire protective system of any State. Our reforestation work is well under way, with approximately 15,000 acres set out to young forest trees. The practice of improvement thinnings and modern methods of forest management is yearly receiving more attention by woodland owners. Forest depredations of diseases and insects are given special consideration in regard to their eradication and control in this State."

This last phase of the forest department's activities is by far the most prominent as regards number of employees and expenditure. Indeed, one is tempted to make insect control the basic *raison d'être* of the department. Of the staff of employees, some 720, cited by name, almost one-half is directly engaged in moth-work, and of the total appropriations and contributions from towns and private forest owners, amounting to around $350,000, over $270,000 seem to be chargeable to "moth-work." We say "seem," for while any number of financial statements are strewn through the pages of the reports, it would take a competent accountant to disentangle correctly the direction in which the expenditures are chargeable, since there is no one final financial statement. Some thirty-odd thousand dollars are expended in fire-fighting; some ten to fifteen thousand on improvements in State forests, and the State Forester's general expenses (with a more or less permanent staff of about 40), including nurseries, around twenty thousand dollars. These amounts are partly appropriations by the State, partly and to a considerable extent contributions from municipalities and private sources; but again it would require considerable figuring to separate the two sources as a whole.

Besides the moth inspectors, over 300 forest wardens, located in towns, form a most effective army for propaganda of forestry ideas as well.

Co-operation, far and wide, with municipalities, corporations, and individuals is the principle on which the forest department is based. This co-operation is more or less developed in protective work and in giving advice and assistance in management of woodlots, in planting,

etc. Lately such co-operation is also had with the country farm bureaus.

The war, with its attendant shortage of coal, and hence increased fuelwood demand, has been a blessing in disguise, permitting the profitable utilization of moth-killed material. Thinnings as a means of controlling the gypsy moth had been advocated years before, but the difficulty of disposing of the cordwood prevented more general application of the operation. Last year "forestry paid"—that is to say, the thinnings could be done profitably—as did utilization generally, in cordwood and sawmill operation, under advice and co-operation of the department. Some 874 acres were, under such co-operation, cut with a net profit to the fifteen owners of about $25,000. In 1915, when 1,485 acres were under operation, a net return of only $5,000 was anticipated. These thinnings concern themselves mainly with oak. Nothing is said about the silvicultural results of these thinnings, and we are left in doubt whether a mere utilization of dead or dying material or real silvicultural operations are involved. The need of fuelwood for the military camps has also benefited this part of the activities. The department also became the center of activity in recruiting complete sawmill units for England under a fund of $150,000 furnished by the lumbermen of New England, besides enlisting men for similar service organized by the U. S. Forest Service.

Reforestation work, usually on land ceded free of cost, but with the privilege of redemption on the part of the owner under the reforestation law of 1908, had by the time of the 1915 report given rise to 125 plantations on waste land, and during the period of the reports has added 35 more, with nearly 1,300 acres, and altogether some 15,000 acres are planted. Apparently the average number per acre planted is 700 trees—a rather small number. Six nurseries furnish the material also for the State forests and for sale to private individuals; to the latter, in 1917, some 300,000 plants were sold at $7 per thousand for 3 and 4 year olds. A special point is made of the reforesting experiments in scrub-oak lands, the planting being done in openings of the scrub after a fire with 4-year transplants, which in three years appear well established. If it were necessary to clear the scrub, as where it is too dense, the planting would be too expensive.

As regards the methods and the attitude towards the eradication of insect and fungous diseases, we note the following: Creosoting egg clusters is effective with the gypsy moth, but spraying with arsenate of lead is more effective. For this, special auto-truck sprayers are used

which outside the spraying season can be used for other purposes. The breeding and dissemination of parasites in co-operation with the U. S. Entomological Bureau continues. It does not appear whether there is hope of ever coping with the pest to its extinction, although an optimistic note on the value of the work is sounded; but the control in cranberry bogs, which can be flooded, seems to be entirely effective.

The chestnut blight is still rampant, and nothing can be done except timely utilization, in which the department co-operates. The white-pine blister rust, which in the reports of 1915 and 1916 comes in for discussion, is, as far as we can find, left entirely unmentioned in the report for 1917. In the former reports, while the seriousness of the infection is admitted, the author refuses to be pessimistic as to its spread. It is doubtful whether here the wish was father to the thought, as the very extended use of white pine in the plantations and nurseries and the great setback of interest in planting due to the fear of loss naturally inclined the State Forester to an optimistic non-alarmist attitude. We dare not take position for or against such attitude, but believe it the part of wisdom to combat the disease as vigorously as the gypsy moth, which we believe can be done with more hope of success than in the case of the latter, on account of the definite host plants and need of two such.

It is claimed that by systematically cutting and burning weevil-infested shoots for two or three years in plantations the weevil can be controlled in great part.

As regards protection against fire, we have already quoted the boast that "we undoubtedly have the best fire-protective system of any State." In spite of this, the tabulation of causes shows no appreciable decrease of the number of fires during the last six years, and in spite of locomotive inspection, still 35 per cent of the fires are on the average ascribed to railroads and a similar number remains unknown as to cause; hunters, with 12 per cent, being the next largest contributors. The damage during the last ten years has averaged around $170,000, with an average area of nearly 40,000 acres and a cost of extinction averaging $30,000. The service is under a special State Fire Warden, who reports to the Forester, with five district fire wardens, 36 towers and other observation stations connected by telephone, special automobile outfits, with pumps. Co-operation of the Federal Government and with towns, the poorer ones being in part reimbursed for fire-fighting tools, are part of the system.

The law relative to the compulsory disposal of slash and brush following logging operations, enacted in 1914, seems not to have accom-

plished the expected results by 1917 for lack of its enforcement. Better observance is reported for the last year.

A special State Forest Commission to purchase waste lands, instituted in 1914, has so far acquired four small States forests, totalling 11,000 acres, the management of which is placed under the State Forester, so far without special appropriation. But it appears that the Forest Commission may allow some of its funds to be expended on these forests. It is mainly reclamation work and has been begun in a small way.

An interesting incident of the department's work in 1915 was the handling of a relief fund for unemployed, consisting of an appropriation by the legislature of $100,000 and a contribution of the towns of nearly $15,000. This fund permitted the employment of over 1,400 men in clearing roadsides, burning brush, thinning, bushing, and planting some 500 acres, and cutting cordwood. The work accomplished, both in amount and quality, far exceeded the State Forester's expectations. But the next year conditions in regard to labor had changed and lack of labor is complained of.

If we may allow ourselves a criticism as to style, it is that a more systematic arrangement of material would make the reading and taking in the reports easier, besides obviating the frequent repetitions, which bewilder the reader.

We note that the reports are addressed to nobody in particular, but from the language it appears the general public is addressed.

The reader of these reports will certainly be struck with the great variety of activities and the wholly democratic spirit of co-operation which characterizes them. Such co-operation is particularly practicable in Massachusetts, where small forest holdings are the rule. We are impressed with the laudable initiative of the State Forester.

B. E. F.

Our National Forests. By R. H. D. Boerker. The Macmillan Company, New York, 1918. Pp. 238. Price, $2.50.

The title of this volume and the title of the author (arboriculturist of the department of parks of the city of New York), as well as his previous ventures in literary lines, led us to expect something different from the contents of the volume, namely, the natural history of our National Forests. It is, however, an account of the organization and character of work of the U. S. Forest Service, with a brief statement

of how and why the Forests and the Service came into existence, the story based upon the author's seven years' experience in that Service.

We may say at the outset that the work is conscientiously done, and, while it is announced as a "short popular account," it is worth reading by every professional student of the technical art, as it will open his mind better than any other reading to the great, almost bewildering, variety of specialization in forestry work as pursued by a great forest administration, and would serve well as collateral reading in a course on forest administration.

The book can also be specially recommended to intelligent people with interest in open-air recreation. Especially in the West our mountaineering societies contain large numbers of these. It is also of special general and practical interest to inhabitants of National Forest regions, for the land of the National Forests is the land of the cow-puncher, the sheep-herder, and the lumberjack—a land of crude customs and manners, but, withal, of generous hospitality. It is the country of the elk and the mule-tail deer, the mountain lion and the rattlesnake. Its grandeur makes you love it; its vastness makes you fear it; yet there is an irresistible charm, a magic lure, an indescribable something that stamps an indelible impression upon the mind and that makes you want to go back there after you have sworn an oath never to return. Thus forcefully does the author show the National Forest region to contain much of the atmosphere whence springs the vitality and idealism of America. Yet the underlying thought is that the material resources must be preserved if the region is to continue to maintain this virile population, which may be expected in future to contribute much of its vitality to the country as a whole.

The contents are divided into four chapters, besides a lengthy introduction (50 pages). The latter, designed mainly to be an argument for the creation of the National Forests, is, perhaps, the weakest part, being too condensed. The first chapter, which concerns itself with the historical development, suffers from the same fault, some interesting and instructive details being evidently unknown to the author.

The fact that the first reservations were created in response to petitions made by citizens of the locality, engineered by the American Forestry Association, would have been worth recording.

The facts that President Cleveland came near being indicted for his wholesale creation of twenty million acres of reservations, and that the whole reservations policy was on the point of being overthrown, are important enough to be mentioned in even a short account.

The fact that by 1894 a bill was passed by both Houses of Congress creating a Forest Service for the administration of not only the existing forest reservations, but of all federal timberlands, which failed by a legislative accident, should at least have been mentioned.

A misconception is created on page 16 by coupling the appropriation for the Division of Forestry with a reference to the Reserves, for the two had no relation to each other.

Incidentally, we may correct the date of one of these incidents, namely, the beginning of the timber physics work, on page 12, which should be 1888.

From the standpoint of the bookmaker, we find the printer's work excellent, the volume well illustrated, and the publishers' part as is to be expected from the Macmillan Company, but we do not think it a wise arrangement of material to let an introduction of 50 pages, roman numbers, be followed by 19 pages of contents before the real reading begins. This arrangement confuses the reader and also leads to unnecessary repetition. The absence of an index is only partly offset by a very full table of contents.

These criticisms are, however, only of minor points in an otherwise excellent book.

B. P. K.
B. E. F.

Soil Nitrification in Relation to Forest Reproduction. Henrik Hesselman, Skogsvordsföreningens Tidskrift, Häft 1, January, 1918, pp. 1–104.

In a lengthy and richly illustrated article Hesselman, of the Swedish forest experiment station, discusses the fixation of nitrogen in forest soils in its relation to forest reproduction in Sweden. For several years he has been studying the pine heaths of northern Sweden, where reproduction is especially difficult. Early investigations convinced him that the difficulty could not be attributed to lack of moisture. He therefore turned his attention to chemical conditions in the forest floor. Where reproduction is lacking, its failure is generally attributed to the fact that under certain conditions the organic matter of the forest floor is not converted into available nitrogen. These conclusions are based upon numerous chemical analyses of soils and plants under different forest conditions.

Two general classes of forest soils are recognized. In one the transformation of organic matter into available nitrates is complete, while in the other the process stops with the formation of ammonia. To the

latter class belongs the bulk of the Swedish forest, namely, all the coniferous forests bearing heavy growths of moss and lichen. In forests of this type, clear cutting or even thinnings may bring about lively nitrification. The same result may be accomplished by cultivation in which the humus is mixed with mineral soil, even in closed stands. Decaying brush or logs also favor nitrification. If the layer of raw humus is very thick, cutting alone may not suffice to bring about nitrogen formation, although the production of ammonia is increased. Under such conditions, nitrification is hastened by cultivation or burning. Where large openings are made, the increased nitrogen supply, together with increased light, may favor herbaceous growth to the detriment of forest reproduction.

Hesselman enters into a detailed discussion of various theories which seek to explain the favorable action of the various treatments above cited upon soil nitrification. His own theory, supported by previous investigations, is that the bacteria which are most active in nitrification require a certain amount of salts (electrolytes) for their development. He also cites the investigations of the Danish soil bacteriologist, Christensen, which show that one of the most universal nitrifying bacteria, *azotobacter,* occurs only in soil which is rich in salts, especially calcium. It never occurs in acid soils, rarely in neutral soils, but is nearly always found in soils of alkaline reaction. Hesselman's opinion is that all soils are continually being inoculated with nitrifying bacteria. Where conditions are favorable the bacteria develop rapidly, with the result that nitrification is active; but where conditions are unfavorable—*i. e.,* in acid or neutral soils—the bacteria die or do not develop sufficiently to become a factor in soil nitrification.

The function of all the measures recommended to promote nitrification and aid reproduction, namely, opening up the stand, cultivation, and burning, is to supply the salts which are absent in the raw humus and which are required by the nitrifying bacteria.

When the stand is opened by cutting, the addition of green slash may supply enough salts to start nitrification. After the process is once under way, there is a further liberation of salts due to chemical action. Opening up the stand also increases evaporation from the soil, and thus carries up salts from the lower strata. Increased aëration, which is commonly regarded as an aid to nitrification, is not here regarded as a potent factor, because under ordinary circumstances aëration, even in dense stands, is sufficient for the needs of nitrifying bacteria.

Cultivation brings to the surface the mineral soil which contains salts in sufficient quantity to promote nitrification.

Burning supplies salts which occur in the ashes. Another possible explanation for the beneficial effect of burning lies in the theory of partial sterilization, which in recent years has acquired many adherents. Experiments have shown that soils heated to moderate temperature, ranging from 65 to 98 degrees Centigrade, afterwards show a noticeably higher content of food elements, especially nitrates, than before treatment. Plants grown in such soils are more vigorous and of richer color than those growing in untreated soil. This phenomenon has been explained by the English investigators, Russell and Hutchinson, on the following theory: The soil contains, in addition to bacteria, large numbers of protozoa which feed on the bacteria. Moderate heat kills the protozoa, but does not injure the bacteria, which thus are given an opportunity to increase in number. If this theory is correct, we might expect the same result after a ground fire in the forest, providing it is not so severe as to destroy the bacteria and the organic matter.

Good reproduction is everywhere associated with an adequate supply of available nitrates. A high nitrate content, however, is not necessary or even desirable. Old trees are relatively independent of soil nitrification, since in some of the most productive stands nitrifying agencies are inactive. Young growth under such stands, however, shows distinct signs of nitrogen starvation. Numerous instances are cited where pine and spruce saplings apparently suffering from lack of light under an old stand began to grow vigorously after a light fire which burned the litter and ground cover, thus starting nitrification, without damaging the trees. Typical two-storied pine forests are often produced in this manner.

Although fire is beneficial under proper conditions, it may also prove harmful when not rightly used. Due to a lack of understanding of the fundamental principles governing the use of fire, there has been considerable dissension on this subject among Swedish foresters. Harmful effects may result from too hot a fire, which consumes a large part of the organic matter and thus reduces the main source of nitrogen. On the other hand, if nitrification is already active, fire may stimulate it to such an extent that the humus is quickly converted into nitrates which are dissipated in a few years and then followed by a decline in growth. Again, an abundance of available nitrates often produces an overluxuriant herbaceous growth, resulting in the suppression of young seedlings. The rule laid down by Hesselman is, therefore, to use fire only when distinctly necessary. Obviously the question asked by the

practitioner is, How shall he decide in a specific case what measures to adopt? The guiding rule in answer to this question is, that where the humus is comparatively loose, being composed largely of moss and needles, nitrification may be expected to take place when the stand is opened up by cutting. Another good criterion is the type of herbaceous vegetation. Hesselman names a list of plants which are termed nitrophylous and whose presence is regarded as an indication of a soil rich in available nitrates.

Among these plants are the following:

Epilobium augustifolium	Rubus saxatilis
Rubus idæus	Urtica dioica
Senecio silvaticus	Arenaria trinervia
Taraxacum officinale	Fragaria
Galeopsis bifida	Rumex acetosella
Luzula pilosa	Sonchus arvensis
Rubus strigosus	Cirsium lanceolatum

A type of soil in which nitrification is not taking place is indicated by the presence of a ground cover made up of mosses and lichens which do not wilt on exposure to sunlight, or where the ground is covered by a mat of *Aira flexuosa.* Other indicators of nitrogen deficiency are *Polytrichium juniperinum, Vaccinium,* and *Arctostaphylos uva ursa.* Under such conditions a light burning is advocated.

Failure to recognize these two general types of soil is thought to account for many of the differences of opinion in regard to silvicultural practice. The author cites examples to show that the advocates of shelter-wood systems, particularly Wagner's "border-cutting," have worked mainly on relatively good soils, where cutting alone suffices to bring about nitrification. On the other hand, foresters who have advocated heavy cuttings followed by burning or cultivation have, as a rule, dealt with soils in which nitrification is difficult.

The findings of this investigation, if not directly applicable to American forestry, should at least prove suggestive. They probably will find application in the more humid forests of this country, where there is a large amount of decaying organic matter in the forest floor. For such conditions this investigation seems to offer an explanation of the beneficial action universally attributed to exposing the mineral soil by burning or partial cultivation. It is interesting to note in this connection that a system of heavy cutting followed by slash burning is now practised in the Douglas fir forests of the Pacific Northwest.

In open stands, such as the yellow pine forests of Arizona and New Mexico, this investigation can have only a remote application. Here

the soil is for the most part bare, and what little organic matter occurs in the form of dead grass, twigs, needles, and slash decays very slowly on account of a lack of moisture. Some idea of the slow rate of decay may be gained from the observation that brush piles left after logging usually show no appreciable decay after a period of 10 years. The nearest approach to the formation of humus is underneath old trees, where needles and cones have accumulated for centuries. The surface soil underneath this litter is usually black or brown, in contrast with the reddish soil typical of the volcanic formations in this region. That such sites favor the establishment of seedlings is attested by the rather common occurrence of groups of seedlings under standing trees or around stumps. Similar observations have been made with regard to burned brush piles. In the latter instance the favorable conditions may be due to stimulation of nitrification by increasing the salt content of the soil, as suggested by Hesselman. It seems more likely, however, that the condition which favors seedlings on such spots is increased moisture supply due to the elimination of competing vegetation. Although reproduction is favored by allowing litter and slash to accumulate until they become incorporated in the soil, or by burning this material, the net result of these factors in localities where reproduction is generally poor has been largely negative, because the beneficial influences are not sufficient to prevent the death of seedlings at critical times.

This investigation is a striking illustration of co-ordination between different branches of science in the solution of a forest problem. Hesselman is a forest ecologist, but the investigation is based as much upon chemistry as upon forestry and botany. It is noted that for several years the Swedish forest experiment station has had a chemist on its staff. Incidentally it may be mentioned that the staff of this station is made up of specialists who have been attached to the institution for years. This organization, which is in striking contrast to that of our forest experimentations, undoubtedly accounts in a large measure for the high standard of scientific work for which the Swedish experiment station is noted. G. A. P.

The Rockies of Canada. By Walter D. Wilcox. Putnam's Sons, New York, 1916. Third edition. Pp. 300.

For the lover of the great out-of-doors, especially the mountains, this book is a rare treat. Mr. Wilcox is an experienced mountaineer and naturalist, as well as a skillful artist with the camera. The book

is primarily a description of the Canadian Rockies, the finest scenery on the continent south of Alaska; but it is enlivened by many interesting narratives of exploration, and with accurate descriptions of forests, trees, flowers, and animals. The region explored lies in the vicinity of Lake Louise and Banff and the wonderful country lying between and south of the Bow River. This region, which is the cream of the mountains, is now easily accessible to tourists by means of excellent mountain trails and a system of splendid hotels maintained by the Canadian Pacific Railway. A large part is included in the Canadian National Park. Some idea of the stoical Indian mind is given in an incident when one of the party slipped and nearly lost his life. When being carried back to camp the stony Indian guide attempted to console him by this remark: "You think you die? Me think so too!" However, the man recovered.

Accurate descriptions are given of the forests and trees, but chiefly from the standpoint of the physiography of the country and of the artistic impressions. "The trees are spruce, balsam, and pine. On the sunny south-facing slops there are a few large Douglas firs which penetrate the lower mountain valleys from the foothills, but do not live at much higher altitudes than that of Banff, which is 4,500 feet. The open glades are filled with small aspen poplars, willows, and birches, which are practically the only deciduous trees. The scrub-birch (*Betula glandulosa*) is rarely absent from any mountain meadow. The white spruce (*Picea engelmanni*) is found everywhere throughout the mountains, from the lowest altitudes to the highest limits of tree growth. . . . The balsam spruce [Alpine fir] (*Abies subalpina*) has about the same range as the white spruce, but is less common. . . . There are two kinds of pine, black pine [lodgepole] (*Pinus murrayana*), which cannot endure high altitudes, and the white-barked pine (*P. albicaulis*), which is found on rocky slopes at greater heights. . . . The most interesting and by far the most beautiful conifer is Lyall's larch (*Larix lyalli*). . . . It is restricted to the summit range of the Rockies and its southern limits have not been determined. . . . It rarely lives at altitudes below 6,000 feet, the extreme range being 5,600 to 7,600 feet. Probably no other tree in the world endures such stress of weather. The Douglas fir is only found in the foothills east of the mountains or in valleys which are less than 5,000 feet above tide. Here it is found in company with the aspen poplar (*Populus tremuloides*) and the cottonwood (*P. balsamifera*)." The hemlocks occur only west of the Columbia River, in the

Selkirk Mountains and westward. Both species are found at Glacier. They are not mentioned in this book, as they are not included in the region explored.

The floral displays are very beautiful, each season having its own characteristic species. "The succession of flowering plants has reserved mid-August for the glorious climax. From our tent we could look over seas of untold millions of wild asters. For a quarter of a mile in every direction the dominant tone was a pale lilac color. The sun when it pours a flood of light over these wild flower gardens gives a marvelous sensation of cheerfulness." The wild flowers are described in considerable detail. A chapter on hunting, fishing, and wild game and one on the stony Indian, won over to friendliness for the white man through the noble life of early missionaries and subsequent fair treatment by the Canadian Government, complete the book.

The full-page photogravures are one of the best features of the book and deserve special mention for their artistic beauty. Concerning these the author says: "Many were obtained only after patient effort and long delays while waiting for a favorable opportunity. Nature, especially in the mountains, reveals her most inspiring moments so rarely that only a tireless patience may claim the prize of a perfect picture."

This work is on a par with John Muir's "Yosemite Valley," although the author's style is different and does not perhaps quite reach the sublime depths of feeling of that wonderful student of nature.

H. D. T.

Tidal Lands: A Study of Shore Problems. By A. E. Carey and F. W. Oliver. Blackie and Son, London and Glasgow, 1918. Pp. xiv and 284. Price, 12s. 6d.

This book is by a marine engineer and "a longshore botanist." From the engineering standpoint the book shows a wide experience and abundant information regarding the works of other engineers. The botanical part of the volume has been handled by a student of shore and strand flora and their usefulness for preventing erosion.

All who have studied the matter know that *Triticum junceum*, *Arenaria peploides*, *Salsola kali*, and *Cakle maritima* are the first sand-gatherers, but *Ammophila arenaria*, *Glyceria maritima*, *Fescua rubra*, and *Elymus arenarius* soon arrive as the sands deepen. "*P. arenaria*, with its tufty habit of growth, formed the summit of the sandhills, while the broad spreading roots and leaves of *E. arenarius* secured the

base and sides." Finally, *Hippophæ rhamnoides* arrives, the east coast of Lincolnshire being discussed. These are the stabilizers of the established "meals," as the marine hills are called in Lincolnshire, in contradistinction to the inland eolian dunes.

In the case of pure shingle beaches, another series of plants comes in. *Rumex trigranulatus, Silene maritima, Glaucium luteum,* and *Crambe maritima* are the *palisade* type of shingle-holders, along with *Arenaria peploides;* also the *mat* plants aid, namely, *Calystegia soldanella* and *Lathyrus maritimus;* but the most important shingle plant is *Suadeda fruticosa,* of whose great value and use there is a very full and detailed account given. Other species useful for this work of binding the dunes are: *Tamarix gallica, Salix repens, Lycium chinense, Ulex, Cytisus, Cratægus, Ilex, Prunus,* and *Rosa canina.* Then the following trees are suggested: *Alnus incana, Pinus laricio, P. austriaca, P. insignis,* and *Cupressus macrocarpa,* while *P. sylvestris* and *Picea excelsa* and *alba* are spoken of for special purposes; nor are the sycamore, wych elm, walnut, and holm oak forgotten, but for some reason the seaside pine, *P. pinaster,* has been overlooked.

The plants winning the salt marsh from the tidal waters and making it into land are treated almost as fully as the sand and shingle species.

The volume is well illustrated. We consider that its usefulness would be greatly increased by the addition of a glossary giving the meaning of unusual local and technical terms.

E. A. W.

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UTILIZATION, MARKET, AND TECHNOLOGY

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Field Tests Made on Oil Treatment of Wood against Marine Borers. By C. H. Teesdale and L. F. Shackell. Engineering News-Record, 18. 1917. Pp. 833-837.

Quantity of Wood Treated and Preservatives Used in the United States in 1917. By R. K. Helphenstine, Jr. American Wood Preservers Association. Baltimore, Md. 1918. Pp. 22.

MISCELLANEOUS

The University of Washington Forest Club Annual, Volume VI. Seattle, Wash. 1918. Pp. 96.

Contains the following articles: Causes and Remedies of Labor Unrest in the Lumber Industry, by W. F. Ogburn; Possibilities of Future Airplane Spruce Production in the Pacific Northwest, by A. J. F. Brandstrom; The Need and Value of Accurate Cost Records, by J. P. Robertson; The Place of the Trade Journal, by W. E. Crosby; The Present Status of the Wood-preserving Industry in the Pacific Northwest, by B. L. Gröndal; Opportunities for Research Work in the College of Forestry of the University of Washington; French Lumbering, as Viewed by a Washington Forester.

First-aid Manual for Field Parties. By H. W. Barker. U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1917. Pp. 98.

A Message from the Forest Engineers in France. Forest Leaves, October, 1918, pp. 167-70.

Fuels of Western Canada and their Efficient Utilization. By James White. Commission of Conservation. Ottawa, Canada. 1918. Pp. 44.

PERIODICAL LITERATURE

SILVICULTURE, PROTECTION, AND EXTENSION

Silvicultural Problems

In discussing the handicaps to the application of silviculture in Lower Burma, Watson expresses himself, among other things, on the selection method and improvement fellings in the following manner:

The so-called selection system was evolved at a time when the staff was inadequate for supervision. It is admittedly rough and inadequate, and it is hard to realize why to date it has not been replaced by a more rational system. Where only certain species in a mixed forest are salable, any system of selection which bears only on one, or possibly more, species forming a small percentage of the crop must logically result in a great reduction in the stock of the species exploited. The counterpoise was to have been improvement fellings; but so far these have been carried out unsystematically and, apart from this, have failed to keep pace with extraction. Of late years the introduction of the uniform method has been under consideration, but our moves in this direction have been desultory and on the whole negligible in results.

Improvement fellings have been classified in two grades: "O" fellings, for the improvement of the existing stock, and "Y" fellings, to induce or aid regeneration. Where, as usually is the case, the produce felled is unutilizable and unsalable the operation is economically unsound.

"O" fellings progress annually by square miles; but, except in rare cases, where groups of valuable species are freed, the results are barely worth the paper they are described on. "Y" fellings progress annually by acres (in Zigon division there have been none so far). Their cumulative effect as compared with the total area of reserves is so fractional as to be almost negligible.

The most striking feature, however, of many improvement fellings is that they appear to be carried out without any clear object being aimed at. Their general object should be the creation of a homogeneous crop over as large an area as possible. Yet the primary essential to produce this, namely, the careful use beforehand of a preparatory extraction of the salable species that are overmature or interfering

with promising groups, is almost invariably omitted. This omission is equally obvious in the case of compartments that are heavily planted over.

Forestry in Lower Burma. Indian Forester, May, 1918, pp. 212–217.

Nurse Trees in Plantations

The following notes refer to the use of nurse trees in young plantations of hardwoods, chiefly beech and oak. They are based on the experience of annual plantings for the last eleven years—a period which covers the whole existence of the bulk of the nurse trees.

The chief points of a good nurse tree are: (1) Hardiness against spring frost; (2) rapidity of growth when young; (3) light foliage and upright habit; (4) ability to stand pruning; (5) value as early thinnings.

The trees employed in this case have been European and Japanese larch. Of these, the European larch has proved superior in hardiness against spring frost, in lightness of foliage, and habit of growth. Both larches have grown rapidly; the European larch has made the more rapid growth in height, and the Japanese has given the larger bulk of small pit-wood at the age of nine to eleven years. The Japanese larch has the disadvantage of throwing out strong side branches, but it stands pruning well.

The planting distance is 3 feet. Of the 4,840 plants to the acre, approximately 2,500 are beech, 2-1 year; 1,500 oak, 1-1 year, and 800 larch, 2-1 year. Every third row consists of larch and beech alternately; the other rows consist of beech and oak alternately; so that the larch nurses stand 6 feet apart in the rows and the rows of larch and beech are 9 feet apart.

For the first three or four years after planting, the nurse trees have very little influence on the growth of the crop. There is ample space for all, and if after the second year the larch begins to take the lead, it is only as isolated individuals. From the fourth or fifth year the larch takes much more than its share of the growing space. It may be said that as soon as the nurse trees begin to do good to some of the young oaks by their shelter they also begin to injure others by their side shade. From the fifth year until the last of the larch are cut out, the plantation requires close attention and care, directed to obtaining the maximum benefit from shelter and the minimum injury from side shade.

In the sixth year some more pruning of side branches may be necessary. In the seventh to eighth year it often becomes necessary to reduce the number of larch where the oaks are suffering from their shade; sometimes a very severe pruning is all that is needed. In the ninth year at least half of the remaining larch is removed, giving some 350 pit-wood poles per acre. The remainder of the larch are cut out in the tenth and eleventh years, giving another 300 to 350 poles per acre of rather larger size. At the present prices the return from these early thinnings is not negligible; and although a much larger return could be obtained by allowing some of the larch to stand for three or four years longer, this gain would be at the expense of the future crop of oak and beech, which must suffer if any appreciable number of larch are retained in the crop after the eleventh year.

It is possible that some other kind of tree—for example, birch—might possess all the other good qualities of larch as a nurse, but hitherto larch stands alone in the value of the early thinnings.

One feature is noticeable in all the plantations described—the very trifling extent of damage done by the larch canker and aphis.

Recommendations regarding these operations by Professor Fisher in 1907 have been thoroughly justified by the result, both in the good growth of the oak and beech and in the considerable return from the early thinnings of larch.

Transactions of Royal Scottish Arboricultural Society, July, 1918, pp. 173–179.

MENSURATION, FINANCE, AND MANAGEMENT

Annual and Seasonal Increment

A set of interesting systematic increment measurements are published by Milne-Home, the measurements having been made in several plantations, six to eight years in succession. The tabulation gives, besides the year of measurement and age of the plantation, the estimated growing stock, number of stems per acre, average dimeter at 4 feet 6 inches high, per cent rate of growth, mean annual increment, current annual increment.

The percentage rate is figured by Schneider's formula $\frac{400}{nd}$. Unfortunately, a full description of the stands is not given, but from the statement of the number of trees it appears that we have in several cases to deal with rather open plantations, the numbers running for

spruce for the fourth and fifth decade from 440 to 700 trees, and in one plantation in the fifth decade to 275 per acre; in one plantation 670 to 710, in another 275 to 280 for pine in the same decade.

A Japanese larch plantation became measurable in the eighth year, and from the eighth to twelfth year, with 880 reduced to 860 stems, grew at a rate of over 12 per cent, the current increment in the twelfth year being 183 cubic feet and with no sign of decline, the average diameter being 5.9 inches and the mean annual increment 132 cubic feet. The other plantations being over 32 years old, no comparison is to be made with the larch performance.

For the spruce, in the better stands of over 35 to 47 years old, the mean annual increment moves between 71 and 78, the current increment from 79 to 116 cubic feet, the diameters in the oldest and best reaching over 11 inches. In no case is the maximum reached (when current equals mean increment).

The two Scotch pine plantations, from 37 to 47 years old, are evidently poor, the better of the two showing for the last 7 years a constant mean increment of 40 cubic feet and a vacillating current increment in the latter period of 50 to 51 cubic feet.

The best performance in the other plantation, in the forty-fourth year, shows a current increment of 71 cubic feet and a mean of 36 cubic feet.

Most interesting it is to follow the movement of the increment per cent, which with almost precise regularity is a function of time that is sinking with age, due, of course, to the fact that the capital—the growing stock—to which the increment is related is constantly increasing. Thus the highest increment per cent is found in a spruce plantation of 32 years with 6.95, the lowest with 2.44 at 44 years. The pine plantations show the highest percentage at 38 years with 4.75 per cent, the lowest with 2.45 per cent at 47 years.

The author adds: At a moderate estimate it should be possible to increase these results by 20 per cent, which would represent a yield very substantially beyond what is looked for at the present time in continental forests.

Regarding the seasonal growth, this proves variable in different seasons. A table shows for the different plantations the percentage of growth made during each month of the growing season. The averages for all species are:

May	June	July	August	September
19	33	24	20	4

The general conclusions which may be drawn from these figures appear to be that in the average season timber increment commences about the middle of May and attains its maximum in June, during which month one-third of the whole increment is laid on. There is a gradual falling off in the growth during July and August, when in many cases increase in girth ceases. In certain trees, especially on better soils, a small growth is made in September. It has been observed that a cold, backward season, with an absence of sun, may postpone any timber increment until June, but rainfall in the early part of the season is not so important, no doubt because there is rarely any lack of soil moisture at that period. Prolonged dry weather in the latter half of June or in July has, however, a very marked effect on both spruce and Japanese larch, although when sufficient rain does fall the loss of growth is usually made up.

Observations in Connection with Annual Increment of Growing Crops of Timber. Transactions of Royal Scottish Arboricultural Society, July, 1918, pp. 164–168.

Swiss Forest Production

The city forest of Winterthur is one of the best managed and most productive in Switzerland. It contains around 2,800 acres, mostly conifers, and in 1917, without exceeding the sustained yield with a cut of 75 cubic feet, the net return was over $50,000, or over $17 per acre. To be sure, the wood prices were high, 22.6 cents per cubic foot, an increase of 46 per cent over 1916. The workwood per cent was 70, leaving 30 per cent for fuelwood. A nursery of 160 acres furnishes plant material, part of which is for sale.

The cantonal forest of Soleure, also only about 3,000 acres, produced, with a sustained yield of only 37 cubic feet, a little over $8 per acre.

In the communal forests of St. Gallen the cut was 81 cubic feet, with a gross return of a little over $13; net results are not given, but the interesting fact is stated that of the principal cut, 7 per cent was from clearing system, 51 per cent from successive fellings, 40 per cent from selection cuttings.

For the canton Bern it is stated that while in the public forests the cut has remained nearly normal, in private forests it has increased to treble what it was in 1913. The net price has exactly doubled over that of 1915, and is stated for 1917 at 16 cents per cubic foot.

In the canton Vaud the cantonal forests produce at the rate of 61 cubic feet per acre, the communal forests at 57 cubic feet, but the pri-

vate forests at 90 cubic feet (overcutting!), but the net return is more favorable for the communal than for the State forest, being $8.66 per acre and 15.2 cents per cubic foot, as against $8.34 and 13.7 cents.

Journal Forestier Suisse, July-August, 1918, pp. 113, 132–136.

UTILIZATION, MARKET, AND TECHNOLOGY

British Transport and Roads

Unwin draws attention to the need for more roads and better roads in the south of England if the timber in the woods is to be got out with reasonable profit.

The woods are mostly of small area and scattered, and no working plans seem to be available giving position, area, thinnings or fellings, and approximate valuation. The wooded areas are of three types: (1) old oak or beech woods, mixed with ash, alder, elm, etc.; (2) regular coppice with an undergrowth of hazel, ash, and chestnut, with the scattered short-boled standards chiefly of oak, occasionally a few ash; (3) the newer plantations of *Pinus sylvestris, P. austriaca* var. *laricio, Larix europea, L. leptolepis, Pseudotsuga douglasii, Picea excelsa.*

Large areas of hardwoods, mostly oak and beech, are ready for harvest, most of the coniferous material, with, in some cases, large amounts of hardwoods, having been felled during the war; but lumbering operations in this region would not pay, because where the woody areas are in hill country the tracks are too steep or the road surfaces too soft and poor for timber wagons and the rides through the woods themselves not fit for heavy-wheeled traffic. No systematic management has been undertaken. Even large estates do not employ a forest officer, the agent of the estate having general supervision of the woods, and he it is who hires foresters—more properly called woodsmen—to do the cutting. Also, only on large estates are there small sawmills, and so here again good roads would further the lumbering of these scattered areas.

The author suggests the desirability of each owner ascertaining the amount of standing timber on his estate, what is mature, and what could be felled. This information in conjunction with the market requirements would determine whether and to what extent the roads should be improved or new roads built. He makes suggestions as to how this improvement in the road system may be secured. The road board might provide for local roads and bridge work and grants might

be made to land-owners for road-building. In some cases it might pay to establish a sawmill, to which timber from several estates might come, or other wood-using industries. The firmly established chair-making industry in Buckinghamshire is cited as a paying example where economic and forest conditions are known. Co-operation, he thinks, might be best also for nursery and planting operations and a properly qualified forest officer might be given charge of several of the smaller estates.

Quarterly Journal of Forestry, October, 1918, pp. 271–275.

POLITICS, EDUCATION, AND LEGISLATION

Forest Taxation in Scotland

The President of the Scottish Arboricultural Society shows by two detailed exhibits from his own experience that taxation in Scotland is more onerous and unfair than with us, not inducive to private planting. The first exhibit is for an area of over 4,000 acres, where rates are rather low. The valuation is only $7 per acre, but the tax rate, composed of the greatest variety of charges, amounts, in 1918–19, to 84 cents, or 12 per cent on the valuation.

The second exhibit refers to 396 acres, where the rates are higher, but the valuation is lower, namely, $2.50 per acre. Here the charges add up to $3.30, exceeding the valuation. In addition to the regular taxes, death duties have to be paid at the rate of 21 per cent on the net value of any timber sold.

There is a county rate as owner and as occupier, a parish rate as owner and as occupier, a heritor's assessment, a land tax, a minister's stipend, besides an income tax, variously computed, and a supertax.

This tax is heavier than on any other property; a comparison with property in stocks shows that the death duties and supertax on these would be one-third that for the forest.

The author also subjects the planting proposition of the Reconstruction Committee to a financial calculation which is not encouraging.

Transactions of Royal Scottish Arboricultural Society, July, 1918, pp. 169–173.

MISCELLANEOUS

Forest Research Organization

Howard, having spent some time in the Prussian Research Institute, traces the development of forest research in Europe. In Germany, Wedekind in 1826, Carl Heyer in 1845, and a number of other leading foresters around 1860, pointed out the need of such research. In 1867 and 1868 Gayer and Baur sketched in detail organization and methods, and the first real move was made at a meeting in Vienna.

The committee there elected were Wessely, G. Heyer, Ebermayer, Judeich, and Baur, representing most of Germany. They met in Regensburg in November, 1868, where it was decided that the larger States, Austria, Prussia, and Bavaria, should have independent research institutes For the smaller States the professors in the various forest colleges were to undertake research work as part of their duties. Among other things, they discussed the advisability of forming an association to further forest research and suggested an international association. It was decided that the research institutes of all the States were to be combined with the educational branch—that is to say, the president of the forest college was to be president of the research institute.

Germany was the first country to organize its research and to found a Forest Research Association. This association, although really dating from the committee meeting in 1868, was not formally formed until 1872.

The hopeless inferiority of French research is put down by French foresters to lack of men and money and bad organization. If France had attended the international meetings, enough interest would probably have been stimulated for men and money to be forthcoming, and, at any rate, much would have been learned about organizing research.

Although instructions were issued for organizing forest research in 1882, to be under the control of the director of the Nancy Forest College, the instructions were "hopelessly carried out." "Experiments were begun, but were usually badly organized and badly carried out."

In 1911, however, these proposals had not yet materialized and a professor at Nancy stated that he was not very hopeful about them. He confessed that French research was severely handicapped by not taking part in the International Association.

In 1912 all German States of importance had their Forest Research Institutes (combined with the college) united under the German Forest

Research Association (which meets as a rule twice a year), and this, in turn, united with the International Forest Association.

The Prussian Research Institute was started in 1871, though not officially created till 1872, and is united with the Forest College at Eberswalde. There are six branches:

1. Silviculture
2. Physical chemistry
3. Meteorology
4. Plant physiology
5. Zoölogy
6. Mycology (started in 1899)

According to original arrangements, the local forest officer was in charge of the outstation experiment under the control of the *Regierungsforstbeamten* and directed by the research officer; but this was not successful. Pressure of other work, lack of technical knowledge and training in experimental work, and other reasons tended to show that the local forest officer was not the man to carry out the experiments.

The principal work of the silvicultural branch is the compilation of yield tables and the collection of statistics connected with them, while other work embraces relations between stacked and solid volume, experiments with exotics, experiments concerning root-formation, manure, technical properties of wood, seed tests, etc.

It is worth noting that the tests of strength of wood, etc., are done by technical experts at Charlottenburg, and not by the Forest Research Institute, and that the silviculturist represents the forest side of these experiments.

The meteorology branch is concerned with experiments dealing with the influence of forests on climate and not so much with the reverse. All kinds of observations on temperature, humidity, winds, etc., are made.

The plant physiology branch is purely botanical. It takes up such subjects as researches on bacteria, formation of annual rings, grass floras, influence of the district on seeds, influence of soil factors on plants, natural distribution of forest trees, etc.

The zoölogy branch is concerned with zoölogical researches as far as they concern forests, and with control methods.

Physical-chemistry branch has to do with the chemistry of soils, humus formation, hard-pan formation, etc.

The mycology branch is concerned with mycology in its relation to forestry, and control methods.

The writer, having Indian conditions in mind, thinks that decentralization beyond the point of provincial silviculturists would be a mistake. The methods and ideas must be controlled by a central body, if any unity is to be obtained. Thus the various experiments in each German State are carefully discussed, and an exact procedure and method is passed upon by the German Forest Research Association before the experiment is started.

The writer concludes that it is high time the prejudice against introducing European methods into India should be done away with. "Local conditions certainly influence all work, but they influence *details* far more than *principles*."

Indian Forester, September, 1918, pp. 394–401.

EDITORIAL COMMENT

"Landscape Engineering in the National Forests"

Under the above title,[1] Mr. Frank A. Waugh has prepared a most readable and interesting little pamphlet which every forester ought to read and study. He follows this up by one on "A Plan for the Development of the Village of Grand Canyon, Arizona." [1]

Since both of these studies discuss some very important principles involved in the proper use and best enjoyment of lake and stream, seashore and mountain, it would seem valuable to get the opinions, especially of foresters, landscape men, and others who have to deal with these problems. It is chiefly to make a start, then, that these lines of an amateur are offered.

Here in Michigan and in other parts of the Great Lakes country hundreds of lakes are surrounded with lots; backyards as well as pretty front ones form shoreline decoration. The traveler is asked to keep away by signs and dogs; the lake is "closed," except to the boat, but landing is *verboten*.

Our beautiful rivers have been closed, have had their banks and bluffs devastated. They have ceased to belong to the people; they have ceased to furnish the refreshing and restful diversion from city life.

Why all this? Has it paid? Even our Atlantic seacoast for miles is closed to the traveler by people buying large estates and fencing out the public.

Waugh's article on the "Summer Camp" brings out this same situation, and the questions naturally arise: Is it necessary? Is it good policy? Is it not time right now to consider this and stop future mistakes, even if we are helpless regarding the past? Waugh apparently had something of this kind in mind when he leaves a strip along the lake as reserve (*see* map, p. 18).

We bother our heads about the number of people per acre, the division of land into lots; but the first question seems to be: Should any private dwelling and ground (even if rented) be allowed on any lake? Should a few hotels, boat-houses, and other truly public affairs be allowed? Should any structures and other human disfigurement be

[1] U. S. Department of Agriculture, Forest Service, Washington, D. C., 1918, pp. 23 and 38, respectively.

allowed at all? If only hotels and other public affairs are allowed, how far back or away should private buildings be located?

Naturally, different lake shores differ. At one the bluffs come close; at another lots of easy ground exists, etc. But the fundamental questions stay. To my mind, one-half mile from lake, or river, or shore, or park is not very much. These people are not busy city-dwellers; they are benefited by walking; and if the shore is free to all, the "hog" spirit goes, and we can all sit together on "inspiration point," if we choose.

There is a further consideration. The number who can have lots at the lake is limited, anyway. Then why not limit on larger lines? Make lots 300 feet along the shore, set houses back 300 feet, and thus utilize, but limit, *before* crowding. That there would go up a shout of hog, and pets, and preference, and pull is a matter of course; we have the same shout when we try to stop shanty towns in cities.

Coming, now, to the Grand Canyon village. I want to agree with Waugh in saying that it is not necessary to keep all buildings away from the rim, and also that it is useless to limit structures in size and form and try to make them invisible. Things are big here; the ordinary man standing at the rim does not see the camps in the park below. Then, why shout about a few hotels and other buildings which give so much pleasure, especially to old people and invalids and children, when they can sit on the veranda and enjoy the sights? Briefly, I feel that private "hogging" of rim and pushing back of people ought never to be allowed. The rim is sacred and belongs to all. Any village affair should be large, not on pigmy city lines, and plenty of the open pine woods to give the air of comfort and seclusion. The politics can well be left out; if Washington can be run by a three-head Commission, this village certainly can, and, in view of its transient character, should so be run.

I must find fault with the estimates. Let us do things in keeping with their importance. Put in $10,000 and send down a commission made up of the foremost authorities on forestry landscape work and sanitary engineering and then ask for a real appropriation, and perhaps the transfer of lands from National Forests to National Parks will go at a slower pace.

F. Roth.

NOTES

Commercial Forest Planting

Nowhere in Canada has such an excellent start been made toward commercial forest planting as in the Province of Quebec, and even here the work done constitutes only a small beginning in comparison with the real needs of the situation. The lead in this direction has been taken by the Laurentide Company, Limited, and the Riordan Pulp and Paper Company, both of which concerns have for some time realized the slow progress which nature unaided makes toward restoring the stand of commercially valuable pulpwood species on our northern lands after they have been heavily cut over.

The Laurentide Company is the pioneer, having started planting operations in 1908. Up to the present, a total of 453 acres has been planted up by this company, mostly with Norway spruce and white spruce, with a smaller representation of white pine, Scotch pine, red pine, poplar, and other minor species. About 1,500 trees are planted to the acre, so that the total number planted to date aggregate some 680,000. During 1919 the Forestry Division of the Laurentide Company expects to plant about 500,000 young trees, mostly Norway spruce and white spruce. The program for 1920 includes the planting of 700,000 trees and for 1921 one million trees, mostly white spruce. The rate of planting is to be increased until it totals 2,000,000 trees per year.

The Laurentide Company has in its forest nurseries near Grand Mere, P. Q., nearly four million seedlings of different ages to be used in planting operations between 1919 and 1921. This will be supplemented by purchases from other nurseries, until the capacity of the Grand Mere nurseries can be increased to cover the entire planting program of the company. The company's forester, Mr. Ellwood Wilson, reports that the cost of planting, usually with 3-year-old seedlings, is from $9 to $10 per acre.

The Riordan Pulp and Paper Company began its reforestation work in 1916, its forest nursery at St. Jovite, P. Q., being established the following year by their forester, Mr. A. C. Volkmar. To date a total of 780 acres has been planted to Norway spruce, white pine, red pine, white spruce, and Scotch pine. In the nursery at St. Jovite are 2,180,000 Norway spruce seedlings, 800,000 white spruce, and 200,000 white

pine of different ages. By 1920 it is expected that the scale of planting will be increased to one million spruce and 100,000 white and red pine, and that operations will be continued at this rate, using 3-year-old stock.

Both these companies are confining their planting operations to lands owned by them in fee simple, readily accessible to existing means of transportation. This will give the plantations a high value when the timber reaches commercial size. In order, however, to encourage large-scale planting on private lands, it is imperative that provision be made against excessive taxation. A low annual tax rate, with an added tax when the crop is finally harvested, is most just to all concerned.

The reforestation of denuded Crown timber lands is a problem of large proportions, the solution of which belongs primarily to the Provincial government. The provincial forest nursery at Berthierville, which has been in existence for nine years, has supplied millions of young trees to private land-owners, mostly farmers and pulp companies, including two million trees sold during 1908. The provincial forester, Mr. G. C. Piche, announces that the capacity of this nursery is to be increased to an annual production of five million young trees, partly in contemplation of the provincial government adopting a program of forest planting on denuded Crown timber lands.

Forest Research in France

The first feature to strike an American is the remarkable skill and fineness of touch possessed by the French foresters and the comparative poverty of their forest literature. The French foresters, by long practice and by living constantly in close touch with their forests, have developed a skill which I believe is unequalled anywhere else in the world. To them forestry is an art, not a science; an art based on the experience of generations. This does not mean, however, that they are satisfied with the methods which their predecessors considered the best. They are constantly trying to improve upon the old methods, and they assert their individuality in the adaptation of their favorite methods to the particular forest. But they seldom write down their ideas; why I do not know. They keep most of them in their heads, so that the only way one can ever obtain a complete knowledge of French forestry is by conversation with the foresters in the woods.

There seem to be several reasons why forestry has developed into an art rather than a science in France. In the first place, the practice of forestry antedates the development of modern science. It had, therefore, started along the road of empirical methods and already possessed

a large body of facts before science was in a position to be of assistance. Secondly, the number of tree species and combinations of conditions are very small compared with those found in the United States.

Perhaps one of the strongest reasons is that the influence of man has been exerted for such a long period that natural conditions have almost entirely disappeared. This makes it impossible to study the vegetation resulting from the action of natural forces.

In America the situation is quite different. France has barely a dozen commercial species, while we have over two hundred; she has no natural forest types, while we have many. Our opportunity and duty are therefore correspondingly greater. We cannot depend upon empirical methods because our species and types are so numerous that it would take centuries, as it has taken in France, to develop the necessary methods. Meanwhile some of our richest types would be lost. We must, therefore, turn to scientific research for the basis of our practice. France makes one realize the vastness of our opportunities for research. We still have large areas of virgin forests and larger areas of second growth of which we know the original growth. It is our privilege as well as our duty to take advantage of the opportunity presented to us to develop research to the point where it will unlock the secret of our natural forests before these forests disappear. With research we can develop our practice rapidly and without wasting our resources. Without it we grope in the dark, for we have not long experience nor as yet accurate knowledge. I have returned absolutely convinced that America can be the foremost country in the world in forest research and in forest wealth.

BARRINGTON MOORE.

PISGAH NATIONAL GAME PRESERVE

The establishment of the Pisgah National Game Preserve of North Carolina is the first concrete case of an area purchased under the Weeks law having been set aside by the President, and its maintenance and the care and control of the fish and game taken over by National Forest officers. As a preliminary to this step the State had through proper legislative action waived control of and jurisdiction over the game and fish within forests established on the purchased lands. Hereafter hunting and fishing will either be wholly prohibited within this area and the preserve used as a sanctuary in which the game may breed and increase without being disturbed, or there will be established certain seasons in which game and fish may be taken under regulations promulgated by

the Secretary of Agriculture. In this way the area will in time become a reservoir of game from which it will overflow onto the surrounding country, thus affording a steady supply of game for recreative hunting. Game and fish thus placed under Federal control will be afforded ample protection from illegal fishing or hunting, the presence of forest officers making it difficult for violators of the game and fish laws to operate and the punishment being often more swift than under State laws enforced by local residents. The State is relieved of all responsibility as to protecting the game and fish on the preserve, and added strength is given to the protection by reason of the game and fish laws being under the charge of Federal courts.

Timber Sales on the Southern Appalachian Forests

The revenue from timber sales on the purchased forests in the Southern Appalachians shows a gratifying and steady increase, in spite of the scarcity of labor in the woods and the high cost of production. Local operators are becoming better acquainted with Forest Service methods and the purchase of Government stumpage is steadily increasing. Timber sales in the Southern Appalachian Forests are of particular interest, as compared with sales elsewhere, on account of the variety of species, both hardwood and softwood, found growing together and of the many different products taken out under one-sale contract. It is no uncommon thing for a single sale, involving two or three million feet of timber, to include some twelve or fifteen species for lumber, with individual species utilized for such by-products as tannin extract and wood bark, telephone poles, railroad ties, pulpwood, firewood, and dyeing material.

Each species and product, as a rule, has a different sale value and so a different stumpage value. This makes the stumpage appraisal, even in a comparatively small sale, a complicated affair. The value on the stump, however, is ample compensation for the difficulty encountered in working up a sale of this kind. Yellow poplar and red oak bring from $6 to $9 per thousand, and the other oaks and chestnut from $3 to $5. Tanbark last spring, owing to war values, had been bringing from $4 to $7 a ton on the stump. There is one chance on the Cherokee Forest, in Tennessee, on which the total estimated stand, converting all products into thousand board feet, is approximately 7 million feet, yet the total estimated value on the stump exceeds $36,000.

The widely varying forest types, due to differences in altitude, latitude, exposure, topography, and soil conditions and the variations in

the mixture of species, present an infinite variety of silvicultural problems. Silviculture in the Southern Appalachians, however, in the last analysis, boils itself down to a very simple proposition. The extreme vigor of these forests, the readiness with which they reproduce themselves from sprout and from seed, and the rapid rate of growth, enable them to recover quickly from the most destructive methods of cutting. Repeated fires and heavy overgrazing are their only real enemies, and with these eliminated heavy cutting does the forest little harm.

A good many interesting logging engineering problems are presented by the timber sales in the Southern Appalachians. The Government has acquired many small tracts of practically virgin timber within easy hauling distance from the railroad, most of which have been preserved from previous logging by the extreme roughness of the topography and difficulty of transportation. Flumes and tram roads are in some instances found possible on account of the demand for lumber and the present high prices.

F. W. Reed.

Red-belt Injury in Montana Forests

A peculiar injury to forest trees on the Helena and Deerlodge National Forests of Montana was reported early in 1918. Examination by specialists in charge of insect control and forest pathology failed to show that either insects or disease were the cause of the trouble, but that it was a form of winter-killing known as the red-belt injury. E. E. Hubert, of the Bureau of Plant Industry, made a detailed examination of the affected areas.

This same condition has been previously noted in Montana and is mentioned in a number of publications covering the winter-killing of forest trees. The name is derived from the occurrence of the injury as a belt or strip of killed or partly killed timber along the contour of mountains and the brown color of the newly killed tree needles.

In the 1918 appearance of the trouble the affected strip was from one-fourth to one-half mile in width and ran parallel to the valley floor. Bordering large valleys, this strip lay at from 5,000 to 6,000 feet elevation, while near the heads of tributary valleys the altitude limits were approximately 1,000 feet higher.

Trees on the more exposed portions of the topography, standing along or projecting above the general forest cover, were the ones most injured. Damage was heaviest on the east, southeast, south, and southwest exposures. All trees on the same site were not affected to the

same extent, though all the trees within the strip showed some injury.

The several tree species were also differently affected, Douglas fir, western yellow pine, and lodgepole pine being the most injured, in some cases as high as 30 per cent of the stand of these species within the belt being killed outright. Alpine fir, Engelmann spruce, and juniper were usually injured only to a slight extent.

A peculiar effect of the red-belt injury was the killing of mistletoe on trees that were only slightly damaged and were capable of full recovery. Mistletoe-infected trees outside of the zone still have living plants of the parasite.

The red-belt injury is apparently due to excessive transpiration of the needles during the periods of Chinook winds, especially when the warm wind has been preceded by an extreme cold spell. This supposition is borne out by a study of weather records for the winter of 1917-18. The loss of water through the quickly thawed-out needles cannot be replaced from the remainder of the tree, which continues in the frozen condition for a greater length of time. This results in the death of the needles and, if enough of the foliage is damaged, in the death of the tree.

A New Forest for the Yale School of Forestry

The Yale School of Forestry has recently received a gift of nearly 1,500 acres of forest in one area. It is the so-called Den forest, some 40 miles southwest of New Haven. It is a mixed hardwood forest typical of southern Connecticut. Accompanying the gift of the land are interest-bearing securities, the income of which will more than pay the taxes; also a fund to pay for a survey of the property. This survey will be made as early as opportunity permits and a bulletin published descriptive of it along the same lines as Bulletin No. 4 descriptive of the Keene forest.

As the Keene forest is coniferous in character, being chiefly white pine, the addition of the Den forest, which is hardwood in character, places the school in a strong position as to forest ownership. Improvement on the Keene forest has progressed rapidly during the past year, and cleanings made to free young stands of white pine from overstanding gray birch and other hardwoods have netted the school more than $1,000. Similar improvement work is now in progress.

Two additional areas adjacent to the Swanzea tract, approximately 140 acres in area, have been purchased and two detached tracts located some distance from the Swanzea area have been sold, it being the policy

of the school to dispose of the more inaccessible holdings and extend the forest near Keene as opportunity permits. The school now owns approximately 2,500 acres of forest, with funds available to increase this by several hundred acres.

Germination of Yellow-poplar Seed

To those foresters who have occasion to handle yellow poplar (*Liriodendron tulipifera*) in the nursery, the results of an experiment at the University of Michigan may be of interest.

Having had very poor success in securing germination of yellow-poplar seed when bought from dealers and stored in sacks in cold storage, it was necessary to locate the trouble.

Through the courtesy of Mr. I. C. Williams, Deputy Commissioner of Forestry of the State of Pennsylvania, a supply of the seed was obtained in the fall of 1917 which was fresh from the trees.

Upon receipt of this seed, in November, two pounds were sown immediately in a 4 by 12 bed and covered with a mulch of leaves. A second lot of two pounds was stratified in moist sand, and the box containing the sand and seed was buried in sandy, well-drained soil. A third lot, also of two pounds, was placed in a cloth sack and hung in a cool, dry cellar. In May, 1918, the second and third lots of seed were sown in 4 by 12 beds in the usual way.

A count of the seedlings in each bed, made in October, showed the following results:

Lot No. 1 (seed sown in fall)	487 seedlings
Lot No. 2 (seed stratified and sown in spring)	1,088 seedlings
Lot No. 3 (seed kept dry and cool, sown in spring)	8 seedlings

The conclusions are obvious. Seed should be obtained fresh from the tree and kept moist and cool until sown. Under our conditions, spring sowing with this species is apparently better.

L. J. Young.

The cost of operating the National Forests for the fiscal year ending June 30, 1918, was $4,000,000, plus $700,000 special deficiency appropriation because of the very serious fire situation. The receipts for this period totaled over $3,574,000, exceeding those of the previous year by almost $120,000. All revenue-producing activities of the forests, excepting the timber business (lessened in consequence of the general let-up of private building on account of the war and of the dislo-

cation of transportation facilities) and perhaps permits for water power, contributed to the increase in receipts; but officials believe that the main increase is due to the number of live stock grazed, which yielded over $1,700,000, timber sales yielding the next largest amount, namely, $1,500,000. Other forms of activity brought in $120,000, the sale of turpentine privileges on the Florida Forest a little over $8,000.

The use of the National Forests is to a great extent free. For instance, settlers and residents of small communities in and near the forests are allowed without charge reasonable amounts of wood for fuel; settlers may obtain timber for use in the improvement and maintenance of farms and are given the privilege to graze free not to exceed ten head of milch and work animals.

The Imperial Forest Research Institute at Debra Dun, India, instituted in 1905 (?), gives an exhibit of its activities in a list of publications (for sale) in the July, 1918, number of the *Indian Forester*. The publications are divided into eight classes, namely:

1. Bulletins (old series)	11
2. Leaflets	5
3. Pamphlets	16
4. Bulletins (new series)	37
5. Forest Records (volumes)	6
6. Memoirs	14
7. Manuals	8
8. Other publications	14

While most of these publications have interest only for Indian foresters, some of general interest may be cited:

Notes on a Visit to Some European Schools of Forestry, by E. P. Stebbing.
Note on the Influence of Forests on the Storage and Regulation of the Water Supply, by S. Eardley-Wilmot.
A Glossary of Forest Technical Terms for Use in Indian Forestry, by A. M. F. Caccia.
The Compilation of Girth Increments from Sample-Plot Measurements, by R. S. Troup.
Note on an Enquiry by the Government of India into the Relation between Forests and Atmospheric and Soil Moisture in India, by M. Hill.
The Selection System in Indian Forests as Exemplified in Working Plans Based on this System, with a Short Description of Some Continental Methods, by A. M. F. Caccia.
Indian Woods and Their Uses, vol. 1, pt. 1, Economy Series, by R. S. Troup.
Preparation of Forest Working Plans in India, by W. E. D'Arcy.
Practical Determination of the Girth Increment of Trees, by R. S. Troup.
Translation of M. Jacquot's "Incendies en Foret," by C. E. C. Fischer (out of print).
The Work of the Forest Department in India, by R. S. Troup.

These publications may be obtained from the Superintendent, Government Printing, India, Calcutta.

The Laurentide Company at Grand Mere, P. Q., is making some interesting experiments in the grinding of hardwoods. In a recent letter Mr. Ellwood Wilson, manager, Forestry Division, mentions the methods used and the results obtained, as follows:

"In order to determine the practicability of grinding hardwood, the Forestry Division got out about sixty-five cords of hardwood with which to run the test. This wood was stored in the yard for several months and finally, on August 17, 1918, we started to grind on No. 7-A stone; the stone was practically new and we used a six-cut straight-tooth burr for sharpening. The test covered a little over two days and the results, both from a quantity and quality standpoint, were very gratifying. The average production was 77,000 pounds per stone per 24 hours, dry weight, and the quality was good, viz., the fibers were very fine and quite uniform, and I think for summer conditions 10 or 15 per cent of this pulp would be beneficial to our stock as a whole. The pulp produced was a slightly darker color than the ordinary run, and of course was run much thinner in the pits in order to prevent burning. The wood as weighed into the mill averaged 5,483 pounds to the cord and was 76.42 per cent dry."

Regarding tie specifications, the *Timberman* says: The new tie specifications issued by the railroads require modification, which already has been done in some cases by the Northern Pacific in the Inland Empire. It would seem that an attempt was made to issue one general specification which would cover the entire production of ties throughout the United States without taking into consideration the various varieties of timber, growth, and inherent defects. The theory upon which the specifications were drawn would clearly indicate that either the committee entrusted with the job knew mighty little about timber or were determined to attempt to secure a theoretical standard tie that would conform with a preconceived notion of an unattainably high standard. A tie inspector for the Great Northern frankly confessed that it would be virtually impossible to secure any ties in Minnesota of the grades suggested. The proper plan is to withdraw the new specifications and amend them in accordance with the experience of the past, through a committee of lumbermen and practical maintenance-of-way officials of the western lines.

The *Indian Forester* for August, 1918, page 376, contains further information about balsa wood, a tropical tree of the West Indies and Central America, belonging to the order Malvacea. Among the many names given to it are West Indian corkwood, "bois flôt," "down tree," referring to the silky floss wrapping the seeds in the long, narrow pods, useful for filling cushions, mattresses, etc. The word "balsa" is a local

name for a type of raft used in certain parts of South America. The wood is soft, spongy, and, as has been stated before, very light, its specific gravity having been given as 0.120. It is used for lifebelts, as cork substitute for bottle stoppers, and for fenders for lifeboats. Experiments to test its suitability, in the form of wood meal, as a material for increasing the sensitiveness of blasting explosives did not give satisfaction; others, however, indicate it to be valuable for an insulating material and for woodpulp for paper-making.

Experiments in the use of sawdust for pulp for newspaper have been carried on in Great Britain with good success. Grinding mills convert sawdust into wood-flour, fresh sawdust being better, as it can be ground finer, than dry sawdust Most satisfactory results have been obtained by mixing 35 per cent of sawdust pulp with 30 per cent of waste (paper), or altogether 65 per cent of home material and 35 per cent of imported pulp. Previously proportions were reversed, being about 70 per cent of imported pulp, with 30 or 40 per cent of home materials. An estimate places the amount of sawdust pulp to be obtained from the United Kingdom per annum at about 20,000 tons.

The Missoula, Montana, office of the Bureau of Aircraft Production has a method of testing pine trees to ascertain whether they will yield wing-beam stock. It consists in making a cut in the butt of the tree and at this point taking a test chip, which must *split straight both ways.* No churned or tapered butts are acceptable, and all logs must have a minimum taper.

Precautions against overripe timber have been issued. Logs with knot defects on one side, however, may be cut if clear airplane cuttings can be obtained from one side.

Pine for wing beams must have not less than six annual growth rings per inch when measured in a radial direction through the zone of maximum growth on either end section. Wood showing not less than 18 annual growth rings in three inches is rejected.

Specifications for pine logs require them to be cut 20 feet 6 inches in length to yield stock 3 by 4½—19 feet 11 inches in length.

Among the fossils found in North Dakota is what appears to have been the immediate ancestor of the gingko, or maiden-hair, tree of China and Japan. This strange tree has come down to us practically unchanged from earliest Mesozoic time. During the Jurassic period it

was widely spread from the Arctic regions over most of the globe, but since that time it has been gradually dwindling, until it is now represented by a single living species in Japan and China. In the Far East it is regarded as a sacred tree, and as such is planted about the temples and sanctuaries, but there is great doubt as to its present existence in a truly wild state. It is not likely to become extinct, however, for its fascinating history and curious fernlike foliage have made it so interesting that it has been extensively planted in many parts of the world, notably in southern Europe and in the eastern part of the United States. It is a familiar shade tree on the streets of Washington, D. C.

The Woodlands Section of the Canadian Pulp and Paper Association, inaugurated a year ago, met on September 20 at the Windsor Hotel, Montreal, Mr. Gerard Power, Chairman, presiding. This Section brings together the practical woodsmen and the responsible heads of woods operations. Many interesting papers were read, leading to hearty discussions, both of which are considered of such significance to the pulp and paper trade that they are being completely reproduced in the *Pulp and Paper Magazine*, beginning with the issue for October 10.

The State of Idaho has made a radical departure from previous timber-sales practice in adopting up-to-date conservative methods of disposing of the merchantable timber on State lands. Twelve million feet board measure and 7,800 ties are being advertised to be sold at public auction at McCall. Minimum stumpage rates of $2 per thousand feet board measure for western yellow pine, $1.50 for Douglas fir and western larch, $1 for Engelmann spruce, $0.50 for white fir, and $0.07 each for ties have been adopted. The timber will be marked or designated for cutting by the State agent in charge. The sale will be made by 40-acre legal subdivisions, according to the estimated amount of timber on each. The successful bidder will be given five years in which to remove the timber. Former sales of State timber were not limited to the merchantable timber; but the entire tract was lumped off by estimate at a flat rate, regardless of species. In some instances the land was sold and the timber allowed to go with the land.

During the past summer Dr. H. N. Whitford, of the Yale School of Forestry, has continued his work in forestry in the Brazilian forests. In 1917 he was in Colombia and Venezuela. In 1918 he visited the southern part of Brazil and made investigative trips to two forest

tracts—the one a hardwood forest on the coast north of Rio de Janeiro and the other in the Paraná forests of southern Brazil. Dr. Whitford reports the hardwood forest to be one of the most accessible in the State and full of a number of timbers that are being extensively used in the Brazilian market, especially since the war has cut off importations. The Paraná pine forest is the most extensive coniferous forest in the Southern Hemisphere and covers a region of not less than one hundred square miles. Since the war, lumber production in this region has more than doubled.

In a bulletin by James White, published by the Commission of Conservation of Canada, discussing the fuels of western Canada, a brief note is made to wood fuel and the equivalents to one ton of anthracite are stated upon the authority of the Forest Products Laboratory, of Madison, as follows: One cord of birch, 1.15 cords of tamarack, 1.20 cords of Douglas fir, 1.50 cords of jack pine, 1.55 cords of poplar, 1.60 cords of hemlock, 2.10 cords of cedar. But the poor grade of coal received in Canada last winter would increase these quantities of wood by probably 23 per cent.

A one-year course in practical forestry is given by the School of Forestry at Montana State University, beginning last autumn. This course is being offered at the request of officials of the Forest Service and lumber companies. It is distinctly a war course, and will fill the demand for a short, highly specialized course of vocational training to prepare for positions now vacant. Applicants for the course must be at least 16 years of age, while students 18 years or more who are not high-school graduates may be admitted if they give satisfactory evidence of being able to pursue the course successfully.

The curriculum for the first quarter is to include introduction to forestry, lumbering, surveying, mapping, mathematics, military drill, and physical education; for the second quarter, forest improvements, scaling and cruising, surveying and mapping, fire protection; for the third quarter, stream measurements, economics of forestry, forest administration.

The development of a large and well-regulated stock industry in the South promises to bring much benefit to timber, according to Austin Cary, who has spent most of the past year in that section. In the first place, it focuses interest on land hitherto idle; secondly, it will bring a

good measure of fire protection in its wake, and, thirdly, a portion of a pasture area appears to be more useful for pasture if covered with a certain stock of timber. The movement to raise more and better stock in the South thus promises to do much for forestry as well as to serve the nation directly. It is gaining fast, many substantial men—lumbermen and others—entering into it. Eradication of the cattle tick, fencing, improvement of stock, improvement of pastures, and provision for winter feed are some of its features. Timber-growing will be a sort of by-product in the beginning; later, if things work as foresters have expected, it may prove to be the dominant interest.

The Taggarts Paper Company, of Great Bend, New York, has developed a process for the making of newsprint from all ground-wood pulp, omitting entirely any proportion of sulphite pulp. The president of the company says: "It requires two cords of wood for a ton of sulphite pulp, while one cord of wood will make more than a ton of ground-wood pulp. It takes 20 per cent more timber to make paper out of 20 per cent sulphite than it does out of all ground wood. One-fifth more acreage of timber is required for the sulphite method."

If this process proves generally feasible, it will do much to conserve supplies and effect a considerable saving in the cost of manufacturing newsprint and in the consumption of sulphur.

An untearable or reinforced paper, also waterproof, has been for many years an object still to be attained by paper-makers, one preventive factor being the high cost of manufacture. The *Little Journal* informs us that the goal has been reached and the goods are being manufactured at last. It is a cotton, reinforced, waterproofed kraft paper. It can be made stiff and hard or creped, and soft and thick or thin. This paper will largely take the place of burlap, performing the double service of (1) paper to keep out the dust, oil, water, and (2) burlap for strong outside wrapping. The Red Cross has used large quantities of this reinforced, waterproofed paper for wrapping surgical dressings and a softer quality is used to make vests for soldiers.

A new quarterly publication, *Jarrah*, devoted to the interests of the Australian forests, has appeared at Perth, western Australia. It is edited by J. S. Ogilvie, secretary of the Australian Forest League. In adopting the name of the Australian wood for the publication it is not the intention of the league, according to an editorial in the initial issue,

to push exclusively the wood of that tree. Other species of Australian woods will be exploited and the influence of the magazine devoted to furthering the interests of the Australian forest resources.

According to the *British Timber Trades Journal*, the Rafanut Aktiebolaget has been formed in Stockholm to exploit new methods of shipping wood, in view of the anticipated shortage of tonnage after the war. The plan is to raft the lumber across the North Sea, and it is to be specially noted that the company's idea is to facilitate the shipment of sawed goods. Some previous experiments in floating large masses of logs have been successful, but it is thought that no previous attempts have been made to float sawed timber long distances at sea.

Irvin C. Williams, deputy commissioner of forestry in Pennsylvania since 1904, matriculated at the University of Michigan Graduate School in October, 1917, as a candidate for the degree of Master of Science in Forestry, which was awarded to him in June, 1918. He is now a candidate for the Ph. D. degree. Mr. Williams became the legal adviser to the Pennsylvania Department of Forestry in 1903. For several years he was lecturer in civil and criminal law at the Pennsylvania State Forest Academy, and is now giving a series of fortnightly talks to the students on general biological and forestal subjects.

Because the appropriation bill for the Department of Agriculture for the current year had not yet been passed, it was necessary to resort to the special defense fund of $50,000,000 put at the disposal of the President by Congress for a loan of $1,000,000 that the Forest Service might meet the necessary fire-fighting expenses attendant upon the serious emergency conditions in the National Forests of the Northwest and Pacific Coast States. The loan was readily authorized by the President, who recognized the protection of the National Forests as a war activity.

The forthcoming report on British Columbia's forest resources, prepared by Messrs. Craig and Whitford for the Conservation Commission of Canada, makes the total stand of timber, including pulpwood, 366 billion board feet. Of the total land area of the province, amounting to 355,855 square miles, 200,000 square miles are incapable of bearing commercial forest growth, and only 28,000 square miles carry sufficient

amounts to be classed as statutory timber land. One-third of the total area, or over 100,000 square miles, once forested has been totally destroyed by fire, and more than half this mileage has been seriously damaged. The loss through forest fires in standing timber is estimated at over 665 billion feet.

It is stated that when, last February, President Wilson was to make a momentous announcement before both houses of Congress the *Chicago Tribune* sold 700,000 copies for that issue. For this issue 84 acres of woodland were cut in Canada; the paper was made in mills along the Welland Canal, where 510 men were kept busy for four days. If the papers had been spread out sheet to sheet they would have reached from Bering Strait to Cape Horn, and if that amount of paper had been bought in the 60's it would have cost $185,000.

Co-operative agreements have recently been made between the State foresters, the Extension Divisions of the Agricultural Colleges of Maryland and Virginia, and the U. S. Forest Service to promote and assist in the marketing of farm timber. The technical control of the work rests with the State foresters and the Forest Service, whose representatives give specific demonstrations under the auspices of the county agents.

Co-operative arrangements have been made with 126 individual owners controlling about 250,000 acres of timber lands in California, whereby the Forest Service assumes the detection and fighting of all fires that may occur. The lands are situated within the territory covered by the rangers of the Eldorado and Tahoe forests. This protection is obtained at an average cost of 1½ cents per acre, paid by the owners.

The *Indian Forester* for August, 1918, contains a photograph showing two seedlings of sal that have come up from one seed, and a correspondent writes that this is not an infrequent occurrence. Many would take the two shoots to be the main stem and an offshoot, the latter appearing before the former died down; but in many cases examination will prove them to be two separate shoots from the one seed.

A total of 2,275 acres was planted within the St. Joe, Lolo, Pend Oreille, and Cabinet National Forests of the Missoula district during

October. The reforestation work was entirely confined to old burns which have failed to restock naturally. The species planted were western white pine, eastern white pine, and western yellow pine. Two and three year old stock from the Forest Service nursery was used.

A. C. McCain, for over ten years assistant district forester in charge of the Office of Operation in the Intermountain District of the U. S. Forest Service, has become supervisor of the Teton National Forest at his own request. Mr. McCain is succeeded in Ogden by Vernon Metcalf, formerly supervisor of the Lemhi National Forest.

George S. Perry, for the past five years forester in charge of the Hull and Brumbaugh State Forests in Pennsylvania, has been appointed a professor of forestry at the Pennsylvania State Forest Academy. He succeeds Prof. George A. Retan, who resigned to take up dairy farming in Tioga County, Pennsylvania.

"The Recovery and Remanufacture of Waste Paper" is the title of an interesting volume which has been written by James Strachan, chemist of the Donside Paper Company, Aberdeen, Scotland. The book itself is printed on paper made entirely from regenerated waste paper.

The students in forestry at the Ontario Agricultural College, Canada, are mostly returned soldiers, the whole student body being less than a freshman class of a few years ago. Courses in forestry have been opened to women and four are in attendance at the present time.

Lieut. J. R. Martin, among the Canadian prisoners in Germany to be repatriated and sent home, was formerly district forester at Nelson, British Columbia. He was wounded four times before being captured and spent twenty-two months in enemy territory.

In the absence of Dean Hunt, of the College of Agriculture, University of California, on war work, Prof. Walter Mulford served as acting dean and director; the forestry school, of which he is the head, was nearly dismantled through enlistments.

Willard Melvin Drake (University of Michigan Forest School, '06), for the past four years professor of forestry at the University of Montana Forest School, has been appointed a professor of forestry at the Pennsylvania State Forest Academy.

Mr. Charles L. Pack, President of the American Forestry Association and head of the National War Garden Commission of the United States, has had the degree of Doctor of Laws conferred upon him by Trinity College, Toronto, Canada.

According to a leaflet issued by the U. S. Department of Commerce, the daily production of paper in the United States is 15,000 tons, 21.4 per cent of which is made from waste paper, books, magazines, etc., of which 380,000 tons are imported.

Six of the sixteen members of the Montana Civilian Rifle Team, which competed in the National Association matches at Camp Perry, Ohio, were U. S. Forest Service employees. A very creditable showing was made by the team.

C. A. Dahlgren, until recently on the Cœur d'Alene National Forest, has been transferred to the Denver office, where he will take over the duties of lumberman. He fills the place left vacant by the resignation of E. B. Tanner.

It is said that over fifty kinds of bark are now used for the manufacture of paper, besides banana skins, bean stalks, pea vines, cocoanut fiber, clover and hay straw, fresh-water weeds, seaweeds, and over 150 kinds of grasses.

Prof. Samuel N. Spring, of Cornell, sailed for France late in October as a Y. M. C. A. secretary. He has been granted a leave of absence from the university for the year 1919.

Forest Examiner R. D. Garver, formerly in charge of entry surveys in the district office at Ogden, has been transferred to the Cache National Forest as deputy supervisor.

Forest Examiner L. F. Watts, formerly in charge of the Pocatello Nursery, has been transferred to the Boise National Forest as deputy supervisor.

Frederick H. Millen was appointed December 1 as assistant forester of New Jersey after two years' service on the staff of the State Forester of Texas.

J. C. Roak, formerly deputy supervisor of the Idaho National Forest, has been transferred to the Kaibab National Forest as supervisor.

Prof. John Bentley, Jr., has been in charge of the courses in lumbering at the Yale Forest School during the autumn term of 1918.

It is estimated that 90 million feet of white pine is used for match stock in the United States every year.

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PRIVATE FORESTRY *

By HENRY S. GRAVES

The emphasis placed on the public forests in recent years has tended to throw into the background the problems of our private forests. The very magnitude of the National Forest enterprise has created in the minds of many people the impression that the problem of forestry in this country is already on the way to definite solution. In point of fact, only certain initial steps have been taken; the most difficult problem, that of the protection and right handling of forests privately owned, is still before us. The importance of the private forests to our country is evident, when one considers that 97 per cent of the timber and other wood products used in the United States is obtained from private forests. Less than 2 per cent of the sawmills of the country are operating on public forests. Private owners own four-fifths of the standing timber of the country, and it is the best and most accessible timber. Nearly the entire supply of certain important commercial species are in private ownership, such as eastern white pine and spruce, southern pine, cypress, redwood, and most of the hardwoods.

The experience of the war called sharp attention to the condition of our remaining timber supplies. The bulk of the material for general construction was obtained from a few large centers of original forest, often involving long rail hauls and high cost. Extreme difficulties were encountered in obtaining promptly an adequate supply of specialized products, like some of the high-grade hardwoods. If the emergency had come 15 years from now, we would have had very great embarrassment in obtaining even the lumber needed for general construction except at great sacrifice in time, cost, and crowding of the railroads. Most of the lumber would have come from the Pacific coast. We may not expect a repetition of such a grave emergency as we have just passed through, but we would be unwise indeed if we failed to recognize that the sources of timber supply upon which we have relied are

* An address delivered before the forestry congress held under the auspices of the Boston Chamber of Commerce and the Massachusetts Forestry Association, on February 24, 1919.

being greatly depleted, with far-reaching economic and industrial consequences.

Many people are deluding themselves with the idea that we do not need to concern ourselves with regard to forests because of large virgin supplies which still exist in the Pacific Northwest, the Inland Empire, and California. I have even heard it suggested that if we should use up or destroy all of the forests in the United States there are very considerable quantities of wood supplies in the great river valleys of Brazil and other South American countries.

Leaders of the southern pine manufacturers state that the bulk of the original supplies of yellow pine in the South will be exhausted in 10 years, and that within the next five to seven years more than 3,000 manufacturing plants will go out of existence. This is an exceedingly significant statement, because it means that the center of lumber production of the United States will within no long time move to the Pacific coast. While it does not mean that there will be an actual exhaustion of all of the timber in the South, it does mean that the competitive influence of southern pine in many markets will be withdrawn, and that there will be the increase of prices that inevitably must follow such an important economic occurrence as the shift of the center of supply of a raw material one to three thousand miles.

One of the most acute problems of forest supplies is that of wood pulp, particularly the material suitable for news print. Already paper manufacturers are embarrassed for supplies. Some of our principal paper concerns have fortified themselves by purchasing large blocks of timber in Canada. Many of you are familiar with the progressive diminution of supplies in the regions like the White Mountains, where private owners are rapidly working back on the high slopes, even stripping off areas which for general public benefits should be kept substantially intact for all time. It is my hope that we may secure sufficient public support to enable us to accelerate the acquisition by the Government of the more important remaining areas before it is too late. The claim is made that the Adirondack State Preserve should be opened to cutting because of the urgent need of supplies for the paper mills in the near future.

The question of supplying the paper mills in Michigan and Wisconsin is even more acute, and it is only a question of time when those mills will have to import their pulpwood from a long distance or liquidate investments of great value in waterpower and plant and move to new sources of supplies. Partly due to the rapid exhaustion of the old sources of wood-pulp supply and partly due to the tariff laws of Can-

ada, American capital is going into that country to build mills to supply this country with wood pulp and paper. Within the last 10 years new mill development for news-print manufacture has almost wholly ceased, while in Canada during that time no less than 28 mills have been built, largely with American capital. It would be possible for me to describe the acute situation confronting many of the other industries that use special classes of forest products, due to the uncertainty in regard to supplies in the future. I refer to industries that use oak, hickory, cherry, yellow poplar, walnut, and ash.

Douglas fir from the Pacific coast is already coming into the New England market. This means that because of the diminishing supplies in the East the prices have risen to a point where it is possible to ship lumber 3,000 miles in competition with that produced locally. With the further reduction of home spruce supplies, the approaching exhaustion of white pine in the Lake States and the withdrawal within a few years of southern pine as a competitive factor, the East will be turning more and more to the Pacific coast. It is estimated that the Lake States, which a few years ago were the greatest producers of timber, are today paying a freight bill of about six million dollars a year to bring in lumber and other products from outside sources.

About 30 years ago New England was not only self-supporting in her timber resources, but exported large quantities to other parts of the country and abroad. Within the last 15 years New England has become an importing region and looks more and more for timber supplies to the South, to the Lake States, and even to the Pacific coast. It is estimated that fully 30 per cent of all the lumber used in New England now comes from outside the region. This is in addition to the importations of large quantities of pulpwood. New England is one of the important centers for wood-using industries. Heretofore many of these industries have drawn upon local supplies. It is estimated that the annual growth in New England of forest materials that will be suitable for lumber or other higher uses is less than half of what is being cut. These are facts of vital interest to a region that has about 300 million dollars invested in the wood and forest industries and employs in this connection over 90,000 wage-earners.

It happens that the area of forest land in New England is about 25 million acres. This is almost the same as the forest area of France, and in many respects the character of the forest has marked points of similarity. France is producing by growth each year 50 per cent more than New England. She has for years been improving her forests and approaching a point where she can furnish most of her domestic needs.

New England by progressive diminution of capital stock and failure adequately to produce forests is going in exactly the other direction, losing ground every year. Before the war France was building up her forest resources; New England has been progressively destroying hers. Before the war France was importing about 80 million cubic feet of lumber. New England's imports exceed this amount. The forest and wood-using industries of France furnished employment to over 700,000 persons, and because the forests were handled in a way to keep up production by growth this employment was permanent. It was the small industries supported from local forests that furnished employment to so many people.

England before the war felt itself quite independent in forest matters. Her command of the seas made it possible to import from many competing countries. She didn't have to practice forestry. During 1915 and 1916 the excess cost over previous years of importing forest materials was 185 million dollars. The next year she had to stop importing almost entirely. She then cut down her meager forests and park timber, and finally had to rely on France, which was supplying the needs of all the armies on the west front. England now plans a great program of reforestation. She proposes to plant up over a million acres in the next 40 years, spending during the first decade over 17 million dollars. England does not intend again to be caught without home supplies.

New England represents in many ways the most favorable conditions for forestry in the country. The region is naturally endowed with excellent types of forest, with valuable species, and a climate favorable for tree growth. There is a large amount of land suited only to growing trees. On account of the large number of wood-using industries, markets for forest products are excellent. Transportation for moving these products is well developed. The public sentiment regarding forestry is in advance of most other parts of the country. Yet even under these favorable conditions, New England is not keeping pace with the destructive influences that are depleting her forest resources.

The situation is much more serious in other sections of the country. We are still drawing upon original timber for our chief national needs. We are not providing for a proper replacement of the old stock by new forest growth. Most of the private timber is cut without any regard whatever for replacement. Destructive processes are permitted that retard or actually prevent the succession of a good forest growth. Region after region is exhausted of old supplies. Remnants of culled forests and patches of second growth are for the most part not being

protected. We are failing to produce by growth the materials that will be needed for local industries, needed to make a large part of our land useful to the State and community, needed to prevent one part of the country becoming dependent on another far-distant part, with the inevitable burden of high prices.

Nature is so prolific that some vegetation usually follows the initial stages of forest destruction. Occasionally by a combination of adventitious circumstances, and in spite of current methods employed, reproduction follows unrestricted cutting or even a first fire of moderate proportions. More often the succeeding growth is inferior. Repeated fires and other abuse cause further deterioration, so that millions of acres of cut-over land are covered with worthless species or brush, or with trees that are so crooked, slow growing, or defective that they will never yield products of value. The fact that there is some woody growth on cut-over lands gives a false impression. Very commonly it is but a screen of valueless vegetation that conceals the effects of forest abuse. Pennsylvania has its great forests of low scrub oak that through repeated fires have replaced a growth of valuable trees. Southern New England has thousands of acres of slow-growing, crooked sprouts of hardwoods replacing pine or thrifty hardwoods. Minnesota has hundreds of square miles of bird cherry and fireweed in place of her former wonderful white and red pine. The South has its worthless blackjack oak replacing the yellow pine. The Middle West has her heavily grazed woodlots that are almost bare of young growth. California has its chaparral or brush, the effect of a destructive system of annual or periodic burning of pine forests.

Sometimes forests are wiped out by a great conflagration like that in Minnesota last fall, which killed several hundred people and destroyed many million dollars' worth of property. Generally the process is slower and less spectacular, but the consequences are just as serious. Already the general effect of depleting our forest resources is being felt by wood-using industries and by the consumers of lumber. Hundreds of communities are suffering because the resource supporting their chief industry has been exhausted. Sawmills and wood-working establishments close, subsidiary industries can no longer exist, the population moves away, farms are abandoned, roads and other public improvements deteriorate, and whole townships and even counties are impoverished. A few individuals may have realized handsomely from the speculative enterprise. The community has been gutted of its principal capital. It has lost the basis for industry and has now only unproductive land that for many years will be a burden rather than a source of

prosperity. This is not an occasional occurrence. It is the history of millions of acres of land unproductive and now an economic desert.

I am advocating a large program of public forests widely distributed throughout the country, but the solution of the forest problem will not come from public forests alone. Even with the most liberal policy of acquiring additional public forests, the nation's needs with respect to forests in the future will have to be met in considerable part from private lands. We point to the forests of France as having met a great crisis in the war. Do you know that 60 per cent of the American supplies obtained in France came from private forests?

You may ask if the increasing interest in forestry of private owners and the operation of State forest laws are not likely to bring greatly changed conditions in the near future. Unfortunately this will not be the case, unless a much more comprehensive and effective program is adopted by the public and there is a radical change in point of view and methods on the part of most timber-land owners. We should give credit to those individual owners and groups who are endeavoring to handle their timber lands constructively. Great credit, too, is due to the State foresters and their supporters for what they have achieved in the face of public indifference and even hostility. But when we consider our forests as a whole, we have hardly begun to stem the tide of forest destruction. Even in the matter of organized fire protection, the effort on private lands is confined chiefly to the protection of the merchantable timber. Cut-over lands and young-tree growth are usually not protected except as may be necessary to safeguard the mature timber, and over a great part of the country there is practically no effort whatever to keep out fires.

Timber-land owners feel that they cannot change their present methods. They have purchased the land to exploit the timber and not to grow a new crop of trees. For an owner who intends to hold his lands forestry is just as essential as is agriculture to a farmer. But most timber-land owners do not intend to hold their lands after cutting the timber, and they see no reason why they should expend money or effort on the land to secure public benefits or to avoid injury to the community. It is the speculative character of ownership that explains the lack of incentive to timber-land owners to handle their lands constructively; and we may not expect that such owners will take any different view or action on their own initiative. The profits of forestry, though very real, do not furnish in themselves a sufficient incentive to cause the change.

In seeking a solution for the forestry problem on private lands, it should be recognized that its very character is such as to require public participation, assistance, and direction. There are certain things that the public should do, and in a liberal spirit, to make forestry by private timber-land owners effective. At the same time the public should insist by adequate legislation that the destructive processes be stopped, and that methods be adopted which will leave the forests in a productive condition. To secure these ends there is necessary a broad program that is practicable and equitable, based on consideration of existing economic conditions. Its formation calls for the most careful constructive thought, with no point of view neglected.

The limits of this paper do not permit the discussion of all the problems that must be considered in an effective program of forestry on private lands. Some principles may, however, be briefly indicated. A program of forestry should include, first of all, compulsory fire protection, and this should apply to second growth and cut-over lands as well as to old timber. State laws should be unequivocal, with adequate penalties, in their requirements upon timber-land owners for protective measures, including the prevention of dangerous accumulations of slashings. Fire protection should be organized and under State supervision. The States should provide an effective organization to enforce the fire laws and to administer the organized protective work. Liberal funds should be made available for patrol, improvements, supervision, and inspection. In most of the States the laws are not drastic enough; there is not sufficient direct responsibility on the owner, and there are not provided adequate means to execute the laws and administer the protective work. The damage by forest fires can be stopped. Its continuance is due to a combined failure on the part of the public and the owners.

The methods of cutting determine whether for one or perhaps several tree generations the lands will be productive or not. The public in its own protection should prohibit destructive methods of cutting that injure the community and the public at large. With the co-operation of the public, constructive measures of forestry are feasible. They should be mandatory.

The States should adopt a policy of taxation of forests that would encourage rather than hinder the practice of forestry. Present tax policies tend to force early cutting and add to the burden of holding young forests.

Other factors also cause premature and wasteful cutting in most timber-land regions. The speculative character of ownership, the bur-

dens of carrying stumpage, the necessity to meet the interest on borrowed capital and other fixed charges, and the uncertainties regarding markets, labor, and other conditions are among the causes of the haste to cut. The result is frequent overproduction, demoralization of the market, and industrial instability. Lumbermen are already appealing to the public to aid them to bring about a more stable condition of the industry. They have requested tax reforms, the naming by the Government of "fair prices," based on cost of production, and the modification of the Sherman Act to permit agreements in restraint of trade for the curtailment of production.

The industrial situation is one that demands the consideration of the public because of the many public interests involved, including the danger to our remaining forests. I do not concur in the proposals that have been made for Federal legislation relative to agreements in restraint of trade, but I believe that public participation is necessary to meet the difficulties. The solution of this problem involves many features that can be taken care of by improvements within the industry itself; others require public co-operation to bring about a sounder basis of ownership and financing of timber lands. In any case aid extended by the public should carry with it an insistence that the forest lands be handled constructively, from the standpoint both of protection and of forest growth. In point of fact, the very measures that would be necessary to secure a right handling of forest lands would go far in solving the problem of instability that constantly menaces the lumber industry and all the interests dependent upon it.

A program of forestry should include, further, co-operation in problems of labor, in land classification looking to the development of agricultural portions of cut-over lands, co-operation in colonization, public activities in technical and economic research, co-operation in the methods of forestry, and so on.

The farm woodlot offers a special problem. The public should lend liberal assistance to the farmer and the small owners, not only in demonstrating the best methods of forestry and in reforestation, but in matters which pertain to marketing the products of the woodlot.

Finally, a program of private forestry is intimately related to that of public forests. We should greatly extend our public forests. Forests on critical watersheds should be owned by the public for their protective value. Public forests serve, also, as centers of co-operation with private owners and as demonstration areas for the practice of forestry as well as furnishing their direct benefits in producing wood materials, as recreation grounds, etc.

We have been discussing these problems for many years, but we have made little progress in securing the right handling of private lands. The need of the general public to have the forest lands of the country productive and the need of wood-consuming industries alike call for the initiation of a broad program of forestry that includes private as well as public forests. I have presented some of the issues as I see them. I urge that those interested in the forest problem join in bringing about some definite and conclusive action.

ROOSEVELT'S PART IN FORESTRY

By Gifford Pinchot

Instead of a formal article from me describing in a balanced way President Roosevelt's service to forestry, will you accept this discursive letter, which neither surrounds the subject nor lays measured stress upon its different parts, but just talks about the man and the leader whom we all loved. Just at the moment I am deep in an effort to defend the Roosevelt policies as to coal, oil, and phosphate, and that comes first.

Some men belong to all people and all time. I suppose it is true that Theodore Roosevelt was loved and trusted by more men and women in more lands during his lifetime than any other man who ever lived. Certainly more men and women followed him in spirit to the grave than ever did the like before for any other man in human history.

Very much of the work that Roosevelt started is yet unfinished. As his great soul goes marching on, we know that at the very heart of the goal to which it marches is that greatest of Roosevelt policies—the planned and orderly development and conservation of the natural resources of America—by no means forgetting the forest, which in a true sense is the mother of all the rest.

No matter how or where you touched him, you could not long delay in finding that Roosevelt was an outdoor man. Gifted in the highest degree with the forester's master qualities of hardiness, judgment, self-control, and the power of observation, Roosevelt brought with him to the White House so deep a sympathy with the foresters' viewpoint that it gave color and direction to all he did touching the great central problem of conservation.

There was no forester but would have liked to have him on the hardest of his trips. There was no time when his mind was not alert for the protection and advancement of the forests. His sympathy with foresters as such was well shown when he broke all Presidential precedents to attend, at a private house, a meeting of the Society of American Foresters, to address its members and to meet them all personally.

Roosevelt's sympathy with forests and his genius for administration made him from the first an active and powerful supporter of the proposal to transfer the National Forests from the General Land Office to the old Bureau of Forestry, and thus to unite the forest work of the

Government under a single head. For more than three years, as I remember it, his recommendations for the transfer were made to Congress, while the personal pressure which he exerted was by far the strongest factor in our final success. Without him it would have been wholly impracticable to bring the transfer about. It was Roosevelt who made the Forest Service possible.

It tells but little of the story to say that Roosevelt saved for us more National Forests than all other Presidents put together. He not only created but defended and preserved them, and when Congress finally took from him the power to add to their number, at the last moment he saved to the people of the United States some 16,000,000 acres more of mountain forest lands. He did it by using the method which has meant so much to forestry and conservation in America, by out-thinking the opposition.

It was William T. Cox, now State Forester of Minnesota, who came to me with the suggestion that Roosevelt should save this forest land before the objectionable provision had passed both houses. When I took Cox's suggestion to him, the President approved it with enthusiasm; the Forest Service was ready; the necessary field studies had been made; the maps had been drawn; we knew what we wanted and we knew how to get it. It remained only to prepare the official proclamation for each addition to the existing National Forests.

For 48 hours the drafting force of the Forest Service worked night and day. As fast as they prepared the proclamations they were taken to the White House. As fast as he received them the President signed them, and sent them at once to the State Department for safekeeping. Thus Roosevelt saved from destruction and set aside for all the people an area more than half as large as the State of Pennsylvania, and did it in the short interval while the bill was passing and before it passed.

No other President has ever been, and doubtless no other ever will be, as practically familiar both with the forest and the range as was President Roosevelt. It was in the early part of his administration that the forest and grazing problem in the Southwest became the livest question before the Bureau of Forestry. To the huge gain of the nation as a whole, Roosevelt was thoroughly equipped to handle it. At the recommendation of the Secretary of the Interior, as I recall it, President Roosevelt made, soon after he came to the White House, a decision as to grazing on National Forests in Arizona which I thought to be unwise. Representatives of the grazing interests of that territory, including, I believe, the present Associate Forester of the United States Forest Service, came to me and set forth their objections to the President's

decision. I agreed with them, and I suggested that, although the President's action had been made public, we might nevertheless put the case before him. We did so, very briefly. With his usual lightning grasp of a situation, Roosevelt saw that he had followed the wrong trail, and without the slightest care that he would be reversing himself in public, he set the matter right. I knew then that he was a great man.

It was the endless good fortune of forestry in America that while it was still young it should have had in the White House so firm, sympathetic, and understanding a friend. How much it owes to him it will never be possible accurately to determine; for the debt of forestry to Roosevelt is not to be counted only in the great things he did for it, but also in the thousands of small advances and advantages which came to American forestry because it was known to be dear to the heart of the first citizen, the greatest driving force, and the most powerful influence in America.

Forestry is firmly established among us today because Roosevelt stood behind it like a stone wall when there was little to it except hope and good intentions.

THE WAR AND THE LUMBER INDUSTRY[1]

By R. C. Bryant

Professor of Lumbering, Yale Forest School

The entrance of the United States into the European war brought the lumber industry of this country into prominence because one of its chief products—lumber—was found to be indispensable to the successful carrying out of the war program, both of ourselves and our Allies.

It may be of interest, therefore, to review briefly the general conditions which prevailed in the lumber industry previous to our entrance into the war, the manner in which the industry has responded to the demands made upon it during the last eighteen months, and to point out some of the weaknesses in organization which became evident as the war progressed.

The year 1913 opened with great promise for the lumber trade, because during the previous year business had been good and a large number of orders were carried over into 1913 by many of the mills. The demand for all classes of building material had been strong during the latter part of 1912, and there appeared to be every indication that the industry would have a prosperous year. By April, however, trade began to slacken, due to reduced railroad buying and to curtailment in building, which was caused by a tightening of the money market. There were few encouraging features developed in the lumber demand during the latter part of 1913, because of general uncertainty in the business world. There was a gradual decline in the price of lumber, beginning in the spring and continuing throughout the year, and buying was for the purpose of filling immediate needs only.

The chief factors causing the depressed condition in the lumber trade appeared to be the uncertainties brought about by tariff, industrial and financial legislation, the Balkan and Mexican troubles, and a partial crop failure in some sections, due to a period of extreme drought.

The year 1914 was looked forward to with optimism, but it proved to be one of slow business and small profits for the industry, due to the uncertainty which existed in the general business world and, later in the year, to the outbreak of the European war. On the whole, the

[1] Delivered before the Society of American Foresters at its annual meeting, at Baltimore, Md., December 27, 1918.

industry received low prices for its product and the demand was greatly curtailed.

The year 1915 showed a marked improvement in general business conditions and was soon reflected in the lumber trade, which was active during the latter part of the year. Southern yellow-pine mills showed a marked decline in stocks on hand from June on—a condition due to the large increase of war business in all industries and to good crop conditions in the country at large.

The year 1916 was one of great prosperity throughout the United States, both to the various industries and to agriculture. The railroads showed heavy earnings which were reflected in large purchases of car materials, among which lumber was an important item because of the scarcity of steel for car construction. The lumber industry responded to the general business prosperity by increased production, which, however, brought about a surplus of stocks. The effect of the latter was reflected in a drop in the price of Douglas fir, southern yellow pine, and other competing woods, due to overproduction. The effect of the latter was a general curtailment of production, which again brought prices up to a fairly satisfactory level. The latter part of the year was marked both by a car shortage, which prevented the movement of lumber, and by an increase in the cost of labor and supplies. The export trade likewise dropped off, due to a shortage in bottoms for this class of trade.

The year 1917 proved a prosperous one for the industry because of the heavy demand for lumber for the construction of cantonments and for other military purposes both here and abroad. The Southern Pine Association barometer shows that at the beginning of the year the stocks on hand were 112 per cent of normal, which increased to 121 per cent in April. Immediately after the entrance of the United States into the war, heavy orders for lumber were placed with southern pine manufacturers, stocks dropping from 121 per cent of normal in April to 96 per cent of normal in August. Shipments rose from 75 per cent of normal in February to 119 per cent of normal in August. Douglas-fir mills did not show such a marked increase in business, because a large part of the 1917 cantonment orders were placed in the South.

The lumber industry was called on in 1917 and 1918 to furnish large quantities of lumber for wooden shipbuilding, airplane manufacture, gun-stock material, box material, and various other lumber products which were essential for the prosecution of the war. Complete figures are not available as to the amount consumed, but the quantity of lumber furnished by the southern pine mills is significant of the strong

market which prevailed. Up to November 1, 1918, the Government had placed orders for southern pine, through the Southern Pine Emergency Bureau, totaling 1,625,000,000 feet, of which amount 300,000,000 feet was ship timbers, 145,000,000 was car material, and 1,180,000,000 was cantonment lumber, export material, etc. The total quantity of lumber of all species furnished to the Government during the last 18 months totals several billion feet.

The extraordinary demands for the production of special material early developed certain weaknesses in the lumber industry, because its organization did not prove sufficiently elastic or resourceful to meet sudden emergencies. One case in point is walnut production. The computed lumber cut of this species in 1916 was 90 million feet, which in 1917 had fallen to 62 million feet. Our entrance into the war called for the production of several million rifles, for the stocks of which walnut is the wood par excellence, and for large quantities of material for airplane propeller blades, for which purpose the wood was especially well adapted. Walnut was produced largely in small mills located in the central hardwood belt, which secured their logs either on the open market or through agents who scoured the country buying a few trees here and there. It early became evident that the customary methods of securing walnut logs would fall far short of producing the required amount of material, and it became necessary for the Government agencies concerned to undertake a campaign of advertising, asking owners to sell their walnut timber; to send men into the field to locate timber and stimulate production; and to instruct lumber manufacturers in the proper method of handling logs to secure the greatest possible output of propeller and gunstock material from them. It also became necessary, on March 28, 1918, to prohibit the use of walnut suitable for the above purposes in any other class of work.

The production of spruce and fir airplane stock on the Pacific coast early developed weaknesses which called for drastic action.

The lumber industry in the Northwest gave no promise of a satisfactory solution of the involved labor question in the woods and sawmills, and it was only when spruce production was placed under the direct charge of a military representative that conditions reached a point which was considered at all satisfactory. The lumberman proved to be an individualist, who appeared unwilling to accept the necessary point of view on the labor question and to merge his own particular interests with the other operators in the region for the general public good. It was only when a Government agency dictated a common policy which all must follow that the proper relations between employer

and employee were established. The lack of harmony was not peculiar to the Northwest, but was evidenced in every lumber manufacturing region. The reason that it stands out prominently on the Pacific coast is that the necessity for the production of specific material was there most pressing, and the industry under the previous methods in vogue could not meet the requirements.

The last eighteen months have brought out very plainly the fact that the industry is extremely provincial in its viewpoint. Such marked sectional differences exist that it appears hopeless to expect the various lumber-producing regions to get together even on economic problems of national interest to the industry. Not only has there proved to be a sectional feeling in the industry, but also an intrasectional one, which does not promise concerted action on questions of national forest policy.

While it is true that the lumbermen have met the demands made upon them by the military program, it was largely because of the Government supervision which was inaugurated soon after our entrance into the war and which served as a governor and stabilizing influence throughout. While the industry on various occasions called attention to its patriotism during the war period, we must not lose sight of the fact that the lumber industry in most regions had a satisfactory price period, and, in common with many other industries, was well rewarded, financially, for the efforts which it put forth. Evidences of a desire to profiteer were not always absent in their dealings with the Government, as was evident at some of the price-fixing hearings, although this disposition was displayed by small groups rather than by the industry as a whole.

The need for some control over the industry, so far as Government requirements and price were concerned, was early recognized, and in May, 1917, there was organized in the Council of National Defense a Lumber Committee, the duty of which was to advise the various Government departments in regard to specifications, possible sources of material, and to serve as a general central source of information on lumber.

It early developed that it was not feasible for the Government to place orders with individual lumber companies, because of the large quantities required and because there was no agency in Washington which was sufficiently familiar with the business of each individual to enable the placing of orders where they could be filled most expeditiously.

To meet this emergency the lumber interests of each producing section organized emergency bureaus, through which orders for a given

wood were placed, and these bureaus then distributed the orders to the individual mills which could best handle the business.

Among the first of these bureaus were the Southern Pine Emergency Bureau, which was organized in May, 1917; the North Carolina Pine Emergency Bureau, organized in May, 1917; the Georgia-Florida Yellow Pine Emergency Bureau, organized in June, 1917; the Douglas Fir Emergency Bureau, later termed the Fir Production Board, organized October, 1917, followed by other bureaus representing hardwoods, hemlock, eastern spruce, wholesale interests, etc. In June, 1917, the Lumber Committee, unofficially, began the allocation of Government orders through existing bureaus to the extent that it advised the various Government departments as to the proportion of a given order of lumber which should be allotted to a given region.

The Lumber Committee of the Council of National Defense continued to function until September, 1917, when the work was transferred to the newly created Lumber Section of the War Industries Board, under a Director of Lumber. The Lumber Section was given added powers over those possessed by the Lumber Committee by an order of the President, and will continue to function up to January 1, 1919, although it has not been allocating new business for some weeks.

One of the important phases of work which the Lumber Section undertook, under authority given to it by the President, was the fixing of a maximum price on lumber for certain species which were of greatest importance in the military program, among them being southern yellow pine, North Carolina pine, hemlock, Douglas fir, eastern spruce, and western spruce. The object of the price-fixing on lumber was the stabilization of lumber prices which would ensure sufficient production to meet the needs of the United States and her Allies.

The bases for price-fixing were provided by the Federal Trade Commission, which investigated costs of production in the different producing regions and which established a cost basis of production, to which was added a reasonable profit to the operator. The costs of production used in fixing prices were set at a point which would enable efficient manufacturers to operate at a reasonable profit. That the prices which were fixed for the various species were just and adequate is shown by the fact that the industry prospered, in spite of adverse industrial conditions.

The signing of the armistice removed to a very large extent the need for Government price control, and, on consultation with the various groups of lumbermen interested, it was agreed between the Lumber Section of the War Industries Board and the parties interested that

the Government base price for each species should automatically go out of existence on the expiration of the period for which it was fixed. Thus the fixed price for eastern spruce expired on December 1, that for southern yellow pine on December 23, and for Douglas fir the date set is January 15, 1919.

There were many interesting phases of Government control of the lumber industry which were inaugurated during the present year, more drastic steps being taken from month to month during the latter half of 1918. It was not found necessary to ration the lumber industry as was done in Great Britain, but steps were taken to control shipments and curtail the use of lumber for what were regarded as the less essential industries. Direct Government needs, including lumber for cantonments, shipbuilding, airplane manufacture, and like uses, were placed on a preference list and were given priority in shipment over lumber destined for less essential uses. Transportation proved to be the keystone of control. Regulations were put into effect establishing embargoes on shipment into some sections and a system of priority permits established, requiring each shipper to have a priority order for a given shipment before it would be accepted by a transportation company. In this way shipments could be made for non-essential civilian requirements only when they did not interfere with the movement of lumber for some preferred use.

There early developed a labor shortage in shipbuilding plants, munition factories, and on other Government projects, and relief was sought by the curtailment of less essential industries through denying them labor and supplies. One of the most sweeping orders was the curtailment of non-essential building operations. It was found that normally 1,500,000 men were employed in building construction, that 25 per cent of the tonnage moved by railroads was of building materials, and that large quantities of steel were used by the trade, which could not be spared, because the total production of steel in the United States during the last half of 1918 would fall short of meeting actual essential requirements.

The War Industries Board thereupon issued an order prohibiting all new construction in excess of $1,000 without a special permit, which was later modified in some minor respects. This served to release a large number of laborers for other work, eased up the transportation situation, which was critical, and made available for military purposes a very large part of the steel production of the country.

Soon after the armistice was signed these restrictions were removed and the building industry was again permitted to take its normal course.

The reaction on the lumber industry of these extreme measures was interesting. The lumber trade submitted willingly to the restrictions so long as the war was actually in progress; but immediately on the signing of the armistice, a hostile attitude was apparent toward any form of Government interference and the demand for the instant abolition of all forms of Government control demanded. This was in marked contrast to the steel industry, which asked for the continuance of price and other control during the period of readjustment. In conformity with the wishes of the lumber industry, all restrictions have been raised; but it seems certain that the best interests both of the industry and the public would have been served by the continuance of some stabilizing factor for at least a few more months.

To those who believe in the theory that the public has an interest in the natural resources of a country, and that ownership of the same by an individual does not grant him the right and privilege of exploiting those resources to his advantage without regard to the welfare of the nation, the attitude of some lumbermen during the war is rather disheartening. Throughout the entire period of the war the industry was held in line by Government restrictions and orders and did aid greatly in the fulfillment of our war needs for lumber. There was exhibited at no time, however, any special interest in the general public welfare, and there was also evident under the surface a feeling of discontent on the part of some, at least, with any form of Government control, unless that control promised to inure to the benefit of the lumbermen themselves. It is true that lumbermen would now be glad to "co-operate" with the Government agencies, provided the "Sherman anti-trust law" was modified to permit them to curtail and thus hold up prices; but with that idea there does not seem to go the conception that the industry should in return so conduct its forest operations that the future of our forest resources should be assured. Lumbermen as a class have failed to grasp the new conception of the relation between the ownership and exploitation of an essential natural resource and public welfare, and the adoption at some future time of a sane and practicable forest policy for handling the private forest resources of the United States must be done over the heads of lumbermen and not in co-operation with them, unless their attitude changes markedly in the near future.

In connection with the work which I have done in Washington during the last few months, I have been greatly impressed with certain weak points which lumbermen either refuse to recognize or the existence of which they do not appreciate. The lumber industry proved to

be narrow in its viewpoint, each producing region working independently, the chief aim, apparently, being to secure the lion's share of Government orders, and every effort was exerted to push the particular species in which a given region was interested without regard to the welfare of other producing sections or of the country as a whole. Intrasectional strifes and competition developed. Differences of opinion on policy also existed among operators from the same region, and by presenting conflicting propositions complicated the administration of Government business in Washington. There was but little evidence of the existence of any real national conception of the problems at issue. This was unfortunate, since only by taking a broad-gauge viewpoint of the situation could the problems be solved with the least harm to the industry as a whole.

In the presentation of arguments before the authorities in Washington, the representatives from the various lumber-producing sections showed that they were not thoroughly familiar with many of the fundamental economic factors upon which the lumber industry is based, and, judging from their attitude, there is but little inclination on their part to improve this situation in the future. It is scarcely conceivable that in an industry which is of such great importance in this country uncertainty should still exist on questions of the true factors underlying cost determination, lumber distribution in all its phases, uses of its product, and like factors. While it is true that lumbermen are devoting considerable time and effort to straighten out cost data, they do not seem to manifest much interest in many other important economic phases of their industry. The dearth of information on the distribution and uses of woods was most striking, and while strenuous efforts were made to collect these data when it appeared that these factors might play a prominent part in the distribution of Government business, the interest in the matter largely subsided as soon as the crisis was past.

Although some lumber-trade associations have collected statistics on production, shipments, orders received and stocks on hand for some years, various inconsistencies were detected in the work when a careful analysis was made of the data. It was found that, due to the manner in which the statistics were submitted by the mills, the figures were largely guesses, and while representing tendencies did not represent actual conditions.

One group of operators, who were an important factor in producing war material, made a strong effort to secure a large amount of Government orders on the plea that in the production of essential material for military purposes they were accumulating large quantities of lumber,

which they termed "side-cut," that could not be marketed. They therefore asked the Government to extend aid to them in moving this material in order that they might continue to produce the lumber required by the United States and the Allies.

On investigation of the current statistics furnished by many of the mills concerned it was found that in many cases shipments had been in excess of production, and that as a whole the mill records did not show an accumulation, but rather in some cases the stocks on hand had decreased as compared to the year 1917. Discrepancies also were detected in different sets of figures for the same mills, so that some doubt was cast over all of the figures presented.

The operators met the situation first by the statement that the figures were incorrect, although furnished by them. No efforts were made, however, to furnish so-called accurate data to prove their case; but, on the contrary, the association refused to furnish other data which might prove their contention. There are indications that the figures did represent the general conditions, and the failure of the association to continue to co-operate in the work after the signing of the armistice has merely added strength to this opinion. The weak point in the whole procedure, from the standpoint of the lumbermen, was that they grasped at one idea only to present at Washington, without previously investigating the situation to see if the facts supported the case. Had a careful study of conditions been made previous to the presentation of the subject, it is doubtful if the issue of large "accumulations" would have been raised.

The whole situation points to the need of more accurate statistics being collected by lumber-trade associations, both for the use of themselves and the Government agencies which are interested in lumber as a commodity. While it may be too much to expect that any far-reaching changes may be effected in the near future which will put this work on a sound basis, there is some evidence that lumbermen are taking a greater interest in this phase of association work than they have in the past.

However, it is not only the lumbermen who are weak on forest economics. The demands for information along this line from various sources during the past year have been frequent, and unfortunately foresters have been able to meet the requirements only to a minor degree. It is one of the weak points in the profession that as yet we have not developed forester-economists who can speak authoritatively on the many vital problems affecting forests and forestry. The profession should contain within its ranks men who are regarded by jurists, econ-

omists, and laymen alike as authorities on cost-finding methods as related to forest products, as experts on tariff questions related to lumber, as experts on lumber distribution, and other like subjects. Why are not foresters called into consultation by courts and Government agencies on questions involving tariff legislation, export policy, lumber transportation, and like issues? It is, I think, largely because we have been content in the past to devote our attention to the problems which seem more closely related to forestry and have neglected the broader economic phases of the subject, which did not seem at the moment of so great interest or of such vital importance.

Forestry is now accepted as a part of our national activity, but we have made but little progress in the practice of forestry on private lands. I feel that one of the ways in which a greater respect for forestry can be inculcated in the minds of lumbermen is for the profession to take a more active part in solving the economic problems of the industry. When the lumberman finds that the profession has a greater knowledge of his business economics than he himself, and when the forester actually shares, as he can and may, in the solution of some of the knotty problems of the industry which may come before Government departments or courts for action, then we may expect to see a desire for co-operation on the part of the lumbermen from the standpoint of self-defense. Until we have some such club to wield we may expect the lumbermen to continue to hold themselves aloof from forestry in most of its phases.

In closing, I want to urge on you the need for the immediate upbuilding of this phase of forestry and the giving of the full recognition to the subject which it demands. Silviculture and related branches of forestry are well and good, but without a chance to apply them on private holdings they come to naught. The entering wedge to private forestry now appears to be through the economic door, and every encouragement should be given to its development.

MARKETING TIMBER FROM FARM WOODLANDS[1]

By F. W. Besley

State Forester of Maryland

The last census reports 6,351,502 farms in the United States, having a wooded area of 190,865,553 acres, or approximately 30 acres per farm. The average annual value of the forest products from each farm was $81, of which 76 per cent represented cut products and 24 per cent standing timber sold. A large proportion of the forest area of the United States east of the 100th meridian can be classified as farm woodlands, and since the farmer, with his relatively small holding, enabling closer supervision, better protection, and more intensive management, is in an excellent position to practice forestry.

It is therefore of the greatest importance to maintain the productivity of these lands, and, in my opinion, there is no better way of reaching the farmer and leading him along the lines of practical forestry than in the assistance that it is possible to give him in marketing his timber under a system of regulated cutting.

USUAL SELLING METHODS

Various methods are followed in the selling of timber. The common practice is for the timber buyer, with a portable mill, attracted by a piece of timber, to approach the farmer with a proposition to buy for a lump sum. The farmer will generally hold off for a higher price than is offered, on the principle that the offer is probably a good deal less than the timber is worth, and to give him time to think it over. If the sale is made on this basis, there may or may not be a stipulation as to the minimum stump diameter. Even if there is, it is usually so low as to leave little of the small, thrifty timber. A minimum stump diameter, especially in hardwoods, does not permit of enough leeway in disposing of undesirable trees and of reserving very desirable individual trees. Furthermore, it is generally so loosely interpreted and difficult to enforce as to be little protection.

Instead of selling the tract for a lump sum, the sale may be made on a price per acre, but the result is practically the same.

[1] Delivered before the Society of American Foresters at its annual meeting, at Baltimore, Md., December 27, 1918.

In selling for a lump sum, the owner knows in advance how much he is to receive, and is relieved of all responsibility in getting out the timber and putting it upon the market.

On the other hand, he usually gets less for his timber, has little control of the operation, and the woodland is left in very poor condition.

A second method is to sell the timber by the thousand feet, or other unit of measure, the price per unit depending upon the kind or grade of material, the operator doing the cutting, measuring, and grading, checked by the owner.

Under this system, the owner is paid on a basis of a classified product, which enables him to follow the operation more closely, and where the cutting and grading is done to advantage, a higher price is obtained for the timber.

The disadvantages are that too much is left to the honesty and integrity of the operator, often leading to disagreements and controversies, and frequently there is excessive waste and poor utilization of the timber, especially in the lower grades, in which there is the least profit to the operator.

A third method is for the owner himself to do the cutting and to market the product direct to the users or consumers, in the case of saw logs selling them to manufacturers or hiring a portable sawmill outfit to cut the timber at a specified rate per thousand feet.

This method often enables the farmer to utilize his teams and help profitably during the winter months and to receive the highest returns, since he is doing away with the middle man. It is particularly well adapted to the marketing of small products, such as firewood, pulpwood, poles, posts, ties, acid wood, etc. Another advantage is that the farmer has full control of the operation in the woods and can limit the cutting to such trees as should be taken, although his lack of knowledge of what to cut and what not to cut often nullifies such advantage.

The chief disadvantages are that the farmer is not usually familiar with timber prices, nor is he in touch with the best markets. In the case of logs and saw timber he does not have the proper equipment for handling them, nor is he experienced enough in classifying and grading to get satisfactory results.

A fourth method often advocated for farmers having small tracts of timber is a co-operative plan by which two or more farmers join in the sale of their products. This method is particularly applicable where a farmer does not have enough timber on his own place to justify an operation, but by combining with one or more adjoining farmers simi-

larly situated the operation presents a sufficiently attractive proposition to enable the owners to secure good prices.

These methods have all been practiced with varying success, depending upon the ability of the farmer in handling timber and in the honesty of the timber buyer. The difficulty is that the farmer who, as a rule, knows little about the value of timber is pitted against the timber buyer, an expert in such matters, with the result that the farmer generally gets the little end of the bargain and is inclined to look upon all timber buyers with suspicion.

The farmer owns the land and is in an excellent position to practice forestry if he can be properly directed. The timber buyer trades upon the ignorance of the farmer as to timber values and methods of handling timber. The farmer needs, and often seeks, the help of the forester, while the timber operator is apt to avoid the forester and attempt to discredit him to the farmer, with whom he may be negotiating.

There should be a common ground upon which the forester can stand and render the greatest service to both. It is only in this way that the practice of forestry on farm woodlands and the marketing of timber can be placed upon a satisfactory basis.

Taking the farmer with the average farm of 138 acres, of which 30 acres is wooded (I am using the census figures); this woodland represents that portion of the farm which, in the farmer's opinion, is of the least value and which he regards as unfit for anything else. He looks upon it as a source of firewood, fencing, and occasionally some saw logs for building purposes, but does not regard it as a productive area in the sense that he does the tilled portion of the farm. It is true that at times it has helped him out with ready cash, often at the expense of sadly depleting the woodland, but these occasions are so rare in the experience of the individual farmer that it fails to impress him with the idea that the woodland can be handled as a constantly producing portion of the farm.

In order to reach the farmer with the principles and practices of forestry, he must be shown practical results and be convinced upon his own land under existing conditions just how the forester can benefit him.

Much is being done these days through the county agents, and these men are in a position to render valuable service to the forester as advance agents. They have to a large measure the confidence of the farmer and the opportunity to start him to thinking of the possibilities of handling his woodland with a view to sustained yield.

As a rule, the farmer does not seek the advice of the forester until there is enough salable timber on the place to invite the attention of timber buyers, or until he is in pressing need of money and wants to know how much his timber is worth and how he can market it. This gives the forester his opportunity, and the successful handling of the market end of the proposition will often be the measure of his success, from the farmer's standpoint.

To the forester this does not often present the ideal conditions under which he can fully put in practice the best forest management, but it does give him the chance to demonstrate to a practical man that forestry has a place in farm management, and it comes at a time when the farmer is ready to do something.

For the past twenty years the foresters of the U. S. Forest Service and those engaged in State work have examined the woodlands of private owners and advised them how to handle their lands. Much of this advice has no doubt been excellent, but the trouble has been that in probably 50 per cent of the cases the good advice of the foresters was wasted, and in such cases little, if anything, was done to improve conditions. The reports submitted were too elaborate, the language used too technical, and the advice given often too impracticable to be translated into action by the farmer. The recommendations generally called for the practice of more knowledge of forestry than the average farmer possessed. His inability to understand the treatment to be given or fear of making mistakes deterred him from doing anything, or resulted in carrying out the recommendations in such a modified form as to render them practically useless. There was evidently something wrong; the trouble seemed to be partly in the failure of the forester to follow up the initial step or failure to provide the farmer with the necessary expert assistance to put the recommendations into effect.

After making, no doubt, many mistakes and experiencing many difficulties, the writer undertook some years ago to work out a plan of cooperation between the Forestry Department and the farmers of the State for marketing timber and other forest products. The plan evolved has been in successful operation for several years, demonstrating its practical value, and I feel safe in presenting it as a working basis for those who have had difficulty in getting small woodland owners to practice forestry.

THE MARYLAND PLAN

1. Examination by the forester.
    a. Full discussion with the owner or agent on the ground.
    b. Written report, with recommendations submitted, outlining prescribed treatment.
2. Marking and estimating the timber.
    a. Trees for cutting selected by forester, marked and measured by helpers.
    b. Information as to logging costs, local timber prices, etc.
3. Working up field data.
    a. Tabulation of marked trees by species and amount, showing board-foot contents and other units of measure.
    b. Stumpage value of timber (price at shipping point less 20 per cent profit less lumbering costs gives stumpage value).
4. Sale of timber.
    a. Prospectus sheet, statement of amount and kinds of timber and conditions.
    b. Form of contract, containing provisions suitable for protection of owner.
5. Inspection of operation.
    a. This is made where requested by owner or when convenient for the forester.
6. Cost.
    a. Owner pays travel expense of examination and travel and subsistence expenses and $3 per day for forester for estimate.
    b. State pays all office expenses and salary of forester.
    The net result is that the owner pays about half and the State about half, making it truly co-operative.

Under the plan above outlined, the preliminary examination of the woodland is made by the forester upon application of the owner and with the owner present, if possible, to discuss the problems presented on the ground. This is important, as it gives an opportunity for the forester to get the viewpoint of the owner, as well as to show him what the problems are and how best they can be worked out. It is often a case of convincing the owner what he should do and of finding out how far he is willing to go in the practice of forestry in view of the conditions presented.

The examination is followed by a written report, with recommendations, submitted to the owner and prescribing a definite method of treatment. It should be added that the treatment recommended does not always represent what the forester feels should be done in the individual cases, but is often somewhat of a compromise between what the farmer wants to do and what the forester wants to do, and constitutes what the forester believes that the farmer is willing to do after having the situation fully explained and the proper results outlined.

In some cases there is no opportunity to do more than impress the farmer with the importance of protection of his woodland, especially the taking care of the young growth and possible improvement cuttings or thinnings to supply his own needs for firewood and other uses.

In a great majority of cases, however, there is enough salable material on the ground to justify an operation, and it is in such cases that the forester can do the most effective work.

In a mixed, uneven aged, hardwood stand, such as is common in the farm woodlands of the East, the selection of the trees to cut and those to be left for future growth is of the greatest importance if the productivity of the woodland is to be maintained, and unless the forester is prepared to carry the farmer through this critical stage a golden opportunity will be lost.

The plan under consideration is designed to do this in an effective way, so that the forester can guide the operation through all of its stages.

MARKING AND ESTIMATING THE TIMBER

At the time of the preliminary examination the foundation is laid and treatment prescribed for the next step of the operation, which involves the selection, marking, and measuring of the trees to cut. This work usually follows some time after the examination and is performed by a man of technical training, although a high-salaried man is not required, since he is carrying out a prescribed treatment.

A good working crew is a forester with two assistants, usually the farmer and a helper. The forester selects the trees and does the tallying, while the two assistants caliper and mark the trees. The mark consists of a blaze four or five feet from the ground, always on the same side of the tree on a given tract to facilitate the inspection, and a check mark, consisting of a blaze on the root or near the base of the tree, stamped with a marking hatchet.

A three-man crew can usually cover about 25 acres per day under average conditions. The work is often lightened by omitting the marking of certain species, all of which may be included in the estimate, such as chestnut, on account of the blight, or certain undesirable species. These may be calipered or diameters estimated without being marked.

Information is also secured to supplement that obtained at the time of the preliminary examination as to logging costs, local timber prices, etc., to be used in connection with general information as a basis for determining stumpage values.

WORKING UP FIELD DATA

This work is done in the office and results in a valuation sheet furnished the owner, showing the number of marked trees of each species, the amount of material they contain, and its stumpage value, based on log run of the various species. The tally is arranged by inch diameter classes and height classes and all deductions for form or unsoundness made in the field. The merchantable content is determined from local volume tables which have been worked up from taper measurements of the important commercial species in Maryland. Stumpage value is generally determined by deducting from the sale price at the shipping point, first a 20 per cent profit for the operator, then the logging, manufacturing, and delivery cost, the remainder representing the stumpage value. From a large number of operations in any given section stumpage values may be determined by comparison. In working out stumpage values the mill-run product is considered and little attempt made to classify by grades.

SALE OF TIMBER

Having marked the timber for cutting and determined the amount and its value, the next step is to bring about a satisfactory sale. For this purpose a prospectus sheet is prepared, setting forth briefly the amount and kinds of timber offered for sale, its location with reference to shipping point or market, the conditions, and such information as would be of special interest to a prospective buyer, except no mention is made of prices.

This form is mimeographed and about fifty copies furnished to the owner, with the names and addresses of as many sawmills and timber operators selected from the State list, taking those who would be most interested in the particular tract of timber. This list of timber buyers is kept as near up to date as possible for the benefit of those having timber to sell. These prospectus sheets are sent out by the owner, and as a result many inquiries are generally received and a number of timber men inspect the timber. As the trees are all plainly marked, the inspection is much facilitated. This placing the seller in direct communication with buyers greatly increases the chance of a satisfactory sale.

When the valuation and prospectus sheets are furnished to the farmer, he is also provided with a form of contract containing provisions suitable for carrying out the operation and fully protecting him. The contract provides for limiting the cutting to marked or specified trees, the protection of young growth and unmarked trees in the log-

ging operation, precaution against fire, and often special provisions, such as the lopping of tops, cutting of weed trees, and the like. One of the provisions of the contract is an arbitration clause which obviates expensive litigation in case of disagreement, and at the same time acts as a strong deterrent in holding the operator to strict accountability.

The owner of the timber equipped with this information is fully prepared to deal with timber buyers and to close the bargain. The sale is made between the owner and the timber buyer, the forester only acting in an advisory capacity.

INSPECTION OF OPERATION

The farmer can closely follow the cutting operation, and, with the trees for cutting so plainly marked, there should be little difficulty in detecting violations of the contract. It is often helpful, however, to have the forester make one or more inspections during the progress of the operation. The moral effect is good, both on the farmer and the timber operator, in the one case to see that he gets a square deal and fully appreciates the importance of protecting his woodland, and in the other showing the operator that the State is interested in seeing the plan fully carried out and that the owner is being backed up.

COST

The owner pays the travel expenses of the preliminary examination and the travel and subsistence expenses plus $3 per day for the forester while engaged in the field-work incident to the marking and estimating. In some cases where the farmer is unable to furnish the help for the field-work, it is furnished by the forester at actual cost. The State bears all expenses of the office work and salary of the forester, the $3 per day paid by the owner representing a part payment. Under this arrangement the owner of the woodland pays about half of the total expense and the State half, making it a co-operative undertaking. The owner is receiving expert assistance at nominal cost, while the State is securing practical results in forest management, and each operation serves as an object lesson in the community, calculated to demonstrate applied forestry in a most practical way.

It is better to make a charge for this work, even though the State may be perfectly able to pay it, and be recompensed by thus promoting the practice of forestry. Of course, the terms of co-operation here suggested can be easily changed to meet different conditions in other

States, even to the extent of charging for the entire actual expense of the service.

The chief value in this plan of selling timber is that from the time the farmer has his woodlands examined and is convinced of the feasibility of the plan of management offered the whole operation is under the forester's guidance, and if he fails to get proper results it is largely his own fault. The forester lays out a plan to begin with, after weighing the conditions on the ground, which has the assurance of being workable, made so by the co-operation of the owner. He selects the trees for cutting and limits the operation to the trees that he has selected. He offers a contract that contains the provisions he considers necessary for securing proper results. After the owner has made some investment in the marking and estimating of the timber, and any change that he might make from the prescribed course would render this valueless, he is rather definitely committed to carrying out the recommendations in toto.

So far as the farmer is concerned, it is quite evident that he is getting the kind of help that he needs at a nominal cost. But inasmuch as it is a market proposition and he is offering the timber for sale, a natural question is, How does the timber buyer look upon the plan?

Timber buyers have traded on the ignorance of farmers so long and so successfully that they are inclined to resent any interference. When this plan was first inaugurated, they condemned it as impracticable and tried to convince the farmer that the forester was trying to work out some theories that were detrimental to his best interests. This, however, was anticipated by the forester, and the farmer was told in advance what he might expect.

There was a tendency among some of the timber buyers to avoid buying marked timber, but this was purely local and never amounted to much. The plan became popular among woodland owners from the first, and so many tracts of timber were marked and the sale limited to marked trees that the timber buyers, already having difficulty in securing available timber, were almost forced to accept the new marketing arrangement. Then, too, the timber men have learned that the estimates make due allowance for logging costs and permit a fair profit to the operators, giving them a fair chance. The tendency is to force out of business the irresponsible, shyster timber buyers and to put the cutting and marketing of timber on a more stable basis.

WOMEN IN SOUTHERN LUMBERING OPERATIONS

By Edw. N. Munns

Forest Examiner, U. S. Forest Service

There are in the Southern States from Georgia to Texas some 125,000 employees in lumbering operations in pine and cypress. Up to the beginning of the war relatively few women were employed on these jobs, even in the office, as the lumber business has been considered as work for men only. To be sure, in the larger companies and in the larger communities women were used to some extent in stenographic and clerical work, but the male element predominated, even in the office force. Now, due to the labor shortage, woman has entered the lumber game, and over 5,000 women are now employed in one capacity or another (December 1, 1918), and just recognition of the place they fill has been given them, both in the office and in the woods operations proper.

Up to the time when labor began to be easier in lumbering work generally, there was a general tendency to employ women whenever possible to take a man's place, for the reduction of the force by 25 per cent or more was correspondingly reducing the production of lumber urgently demanded for ships, cantonments, and the railways. How far women could have gone in this field is largely a matter of speculation now, but it is certain that at least 25 per cent more of the male force in lumbering operations could have been replaced by women, with but little reduction in efficiency or production. To what extent women will supplant the men with a return to pre-war conditions is impossible to determine, and the operators are hesitant in making any statements as to policy during the period of readjustment and reconstruction of national business generally.

It is generally conceded by the lumbermen that the Southern negro laborer in the army has learned much of sanitation, living conditions, and of co-operation, while the man who was not in the armed service learned the value of his time and the dependence of the employer upon him through the bids made for his services in increased wages, shorter hours, and better living conditions by rival concerns or outside interests. Whether the negro will go back readily to the old conditions is problematical; but it is certain that during this transition period, if not

later, women will be utilized to the full. If the labor which has been taken away or has drifted away during the war comes back to the works, it is quite possible that the competition for labor between the men and the women for certain classes of work will be quite keen, and on the heavier work the women will doubtless be replaced almost entirely. The white women, generally speaking, are used on a higher grade of work than the negro women and, broadly speaking, will not be so readily replaced.

The character of the work performed by women in the Southern operations is described under the various classes of work.

IN THE WOODS

Very few white women are employed in the woods. Usually where so used it is on a small operation close to her residence and limited to occupations she considers above a negro's job. This usually takes the form of driving a team, which she is not called upon to load.

Negro women in the woods are much more plentiful and fill a number of places. In team logging they are used as hostlers, teamsters, skidders, and road-repairers, doing in fact almost every conceivable job connected with such work. In machine or steam logging men have been replaced by women as firemen on the skidders and loaders, as wood-choppers, where they handle an axe with great proficiency, and occasionally as signalmen, where they have been found to be as reliable as men. As teamsters on the outhaul line they have given excellent service, supplanting boys and older men who went onto more arduous undertakings.

As fellers and buckers women have not been used to any great extent. In a few operations they have been utilized when the man power of the crews dropped off and the mill could not be kept running. While in such capacities they are unable to do as much as a man, they keep the crew going and mill operating. In such capacities they are about 60 per cent as efficient as men, but cause more loss in the woods from breakage and lack of skill in felling the timber in the right direction. As trimmers they give fair service, doing about three-fourths the work of a man. When possible these crews of women are pitted against the men, creating a rivalry which results in a greater number of logs per crew from the men.

On the logging railroads there are few jobs that the women do not fill, from running the trains to laying the track, the greater portion being employed in the latter work. They are not so often used around a track-layer because of the heaviness of the work and the labor entailed.

IN THE SAWMILL

Women are seldom used in the sawmill proper because of the manual labor required the full day and with little chance of rest from standing the entire time. Occasionally a woman is used on the conveyor chain, picking out pieces to go to the lather or to be used as fuel. At the lather she is used to some extent to tie bundles. One mill utilized a woman at the trimmer with some measure of success, and one as an off-bearer, but the work was too heavy for her.

PLANING MILL

In the planing mill women can be utilized to good advantage. Once the machinery is understood and its limitations and their own learned, the work runs smoothly and with little trouble. As a rule, the planers offer the best chance to the white woman because of her greater adaptability and quicker grasp of situations. One operator stated that he would much rather use white women than negro men because of the greater ease with which they did the same amount of work and the more application and concentration put on the job. This resulted in fewer breakdowns and greater speed in the operation of the machinery. Negro women are not looked on with favor in these positions and boys are used in preference.

In the finish rooms the negro women are utilized in tieing bundles, sorting items and lengths, and similar work. At the grading table white women have been used, and soon are able to grade as carefully and as efficiently as a man. The amount of training given these women is remarkably small, and they soon learn the value of the various defects, and after learning the grades are as apt as the men.

IN THE YARD

In the yards women are used best in clean-up gangs and in repiling lumber, though this latter job requires very close supervision. In the dry sheds the handling of finished stocks is done to some extent by women, especially where the monorail system is used. As many of the bundles are heavy, the number of women on the job is naturally increased, though this is unsatisfactory because of the small working space. At the kilns women are used to load and unload the lumber on the kiln trucks. Practically all this work is performed by negroes.

MISCELLANEOUS POSITIONS

In the shingle mill there are few jobs that the women are unable to fill, except those involving the machinery and handling the bolts, which are usually too heavy. Bundling and clean-up work is readily handled by women.

The negro women make indifferent loaders. At board mills, where finish stuff is handled to a large extent and the stocks dry and of small sizes, they can be utilized to good advantage both as passers and as loaders proper. The work is heavy and rest periods must be given. Heavier material nearly always requires men.

As timekeepers, as talleymen, or checkers the white girl is found to be superior to the men. As in grading, they soon learn the lengths, sizes, and class of material and become as quick in recording this data as the men. Furthermore, their sheets are always much neater and cleaner than those made up by the men—a fact which is greatly appreciated by the office force. In these places it is fairly safe to presume that the operators will not go back to the old order of things, but continue to use women entirely because of their neatness and accuracy.

In the boiler rooms negro women are occasionally employed as firemen, but generally without success because of the nature of the work and their ability to go elsewhere for work.

WOOD-USING INDUSTRIES

The principal wood-using industries connected with the lumber centers are sash and door works, veneer, food containers and box manufacture, and novelty or small woodenware works. In these plants are great possibilities for the development of woman labor because of the lightness of the work and the possibilities of sitting while working. In these places fully 60 per cent of the total employed force may be the woman worker, with no reduction in the efficiency or output of the plant. Among the positions where she is employed at present are in the making up of crates and baskets, of veneers, the bundling of box shooks, stapling, oiling, sanding, polishing, varnishing, handling lumber, running planers or stave machines, etc. In many of these occupations it will be very difficult to get the old system of things again in force.

LIMITATION OF THE WOMAN WORKER IN THE LUMBER INDUSTRY

There are certain limitations which will always prevent women from supplanting men in the lumber business. The first of these is her general lack of strength, which prevents her from doing most of the heavy work connected with the handling of green lumber and timbers, or general work, where the prime requisites are weak heads and strong backs. The second is her constitutional weakness, which imposes the limitations of shorter hours than men, with relatively more frequent rest periods or positions at which she may work while seated. In general, it has not been found wise to work a woman more than eight hours at heavy tasks, as the overdoing of her strength reduced her efficiency to a marked degree. Of course, there are always present a few women of the Amazon type, to whom the heaviest kind of work comes with ease and to whom long hours and heavy work has no terrors. Such women may be employed in any place where men may be used and where she develops skill and care enough to be trusted around machinery.

WAGES PAID

Before woman had been placed in those lines of work which she could handle she was paid much less than men in the same class of work; often but half that paid the men. Boys and women were on a parity as to wages, and often a woman received less than the boy. This has gradually changed, till at the present time women receive in the mill but one or two cents per hour less than the man formerly employed. In the yards and in the docks women in the clean-up gangs and pushing dollies receive on the average about five cents less than men workers. In the woods and on the railroad women receive the same wages as men where the work is piecework—that is, the same rate per thousand and the same rate per trip by rail. In other lines of endeavor they receive about three-fourths of the standard wages paid men. For track work in railroad construction they average 25 cents a day less than men workers, which holds true for the wage received for work in machine logging. Where employed as teamsters they receive the same wages as the men.

White women in general receive the same wage as those paid men whom they replace. As checkers, scalers, machine workers, and in the office they are given the same pay men received as soon as their fitness for the work is demonstrated. Usually in many of these places these women are placed in an apprenticeship status for an indefinite period,

depending on the individual. In the wood-using industries, when she has found her place, she is given the same pay as the men for the same work.

FUTURE OUTLOOK

How successful women are in the lumber industry in the South is reflected in the wages paid them. At the start, when only a few women were employed at occupations for which they were unsuited, a strong feeling of antagonism to the woman worker was apparent, but this was later lost when the work and the women had adjusted themselves through the employer studying his help with the idea of finding the work at which they could be utilized.

This was easier with the white women than with the negro because of her greater adaptability. Negro women work better in groups than when employed singly with men around, and while there always will be a more or less general loss of labor from the combination of sexes in the black race, this loss has not resulted in any great reduction in the work accomplished as compared to the new labor supply opened up.

White women in the South are not employed to the extent that negro women are used because, in general, manual labor in the weaker sex is looked down upon by all classes. Indeed, it was late in the fall when women were used to any extent in the elevator, in the hotels, or in other lines of similar work, while the rest of the country had been using them for at least six months. Once this prejudice has been broken down it will be comparatively easy for women to obtain employment generally. The white women, so far where tried, have proved themselves superior to men in a few lines of work, due to their quicker brain and quicker grasp of mechanical operations, and far superior to the black men in whatever place she has found herself.

The negro women have been tried in positions which largely involved manual labor rather than skill or application. In these positions they have not been as successful as men, and their deficiencies have been due entirely to the lack of physical strength, and this has been met in large measure, where possible, by the employment of a larger number of workers.

THE NATIONAL FORESTS: THE LAST FREE HUNTING GROUNDS OF THE NATION

By Aldo Leopold

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In a previous article[1] I have made the following assertions, which have so far not been disputed:

1. The demand for hunting on the National Forests exceeds the supply.
2. The practicability of increasing production by applying scientific principles is not hampered by inaccessibility, as with timber. Hunting is in demand and is marketable wherever found.
3. Therefore the time is ripe for scientific game management on the National Forests, and its development presents a duty and an opportunity to Foresters.

The foregoing argument is premised on the present relation of National Forest game resources to the present hunting public. It is the purpose of this paper to forecast the future relation of these resources to the future hunting public and to point out certain conclusions bearing on the present game policy of the Forest Service.

What do we know about the future hunting public? There are three points which may so safely be predicted that they require nothing more than a mere enumeration:

First, the hunting instinct is a fixed character, and will continue to appear in a certain proportion of all normally developed individuals. The number of hunters will increase at least as fast as the population.

Second, the proportion of hunters to whom the National Forests are accessible will increase by leaps and bounds. Good roads, automobiles, and airplanes—what more need be said?

Third, the leisure and the means to indulge the taste for hunting will grow with the growing recognition of outdoor recreation as a vital necessity, with the increase of wealth, and with the cheapening of individual transportation.

In short, hunting on the National Forests will in the future attract more people, for more time, from a vastly greater territory. This much is self-evident, and all these factors will operate to intensify the demand for hunting on the Forests.

[1] "Forestry and Game Conservation," Journal of Forestry, April, 1918.

There is only one condition which might operate to partially offset the growth of this demand, and that is the development of more attractive hunting grounds on other territory—that is, on private lands. To correctly forecast the future of game management on the Forests, it is necessary to carefully consider the probable future relation between National Forests and outside hunting grounds.

Game conservation in America has now pretty well passed the initial propaganda stage and people are beginning to think about ways and means. It is no longer a question of whether, but of how. One of the most popular of the various proposed solutions of the "more-game" problem is the doctrine loosely designated as "game farming."

Game farming, as at present advocated by certain radical elements, includes a number of wholly vicious proposals, such as the wholesale opening of markets and the abandonment of restrictive game laws. But it also includes a number of fundamentally sound proposals which have both a direct and an indirect bearing on the question of game on the National Forests. Among these are the artificial control of vermin, the artificial establishment of food plants and coverts, the feeding of game during critical periods, and the maintenance of a stable breeding stock by liberating game artificially reared.

It is axiomatic that as the natural production of a desired natural resource fails, it is supplemented by semi-artificial means of production. This is the long and short of game farming. This is the long and short of Forestry. The aspect of this process which concerns the subject in hand is the fact that these semi-artificial means of production always require an *investment*, and therefore must pay a return on that investment. In short, the product becomes commercialized and the free supply comes to an end, because even the remainder of the virgin supply acquires a sale value.

Game farming, however carried on, requires an investment of money, time, material, or land. Therefore its product, hunting, will be sold to the highest bidder. More concretely, the farmers, who own the greater part of the hunting grounds of the nation, will maintain coverts on little odd corners of land, will winter-feed their birds, will set their boys to killing off vermin, and then will lease their hunting privileges, for cash, to individuals or groups of hunters. It follows that they will post their lands against trespass, and free hunting on farms will be a thing of the past.

It is hardly necessary to point out that this commercialization of hunting privileges will take place first on lands of high value—that is, agricultural lands. It is already foreshadowed by the wholesale posting

of such lands throughout the country. It will take place last, if at all, on lands of low value—forest lands. It is also evident that it will take place first with upland game and last, if at all, with migratory game. But it will, in the not-far-distant future, result in *the end of free hunting* for a larger part of the five million sportsmen now dependent on wild game for outdoor recreation.

Is it necessary to point out the effect of all this on the free recreation grounds of the National Forests? I think not. It simply means that people will flock to the Forests in numbers we now do not even dream of.

They will come there, too, for other reasons than mere inability to own a private shooting preserve or pay dues in an exclusive club. Regardless of cost, there is an ingrained repugnance in the heart of many sportsmen to having their sport served to them in a spoon. There is a certain rugged independence—I suspect inherited from generations of self-respecting yeomen—poachers of the feudal ages—which eschews "boughten" sport. These estimable throwbacks, regardless of financial ability, will choose to test their skill, not on posted preserves, but on the public hunting grounds of the National Forests, beholden to no man or his dollar, but only to the law of the land.

In short, demand for hunting on the Forests will increase not only with population and with transportation, but especially with the rising price of hunting elsewhere. The rate and extent of the increase will probably be greater than we are at present able to comprehend.

This forecast, if correct, certainly contains some lessons in National Forest game policy. What are they?

First and foremost, it means we must do something. It means that the time is ripe for aggressive thought and action on the game question, lest we be overwhelmed by a demand for which we are unprepared. The development and perpetuation of the nation's last free hunting ground—is that not an opportunity for service which should stir the imagination of more than a mere handful of "cranks"?

Secondly, it means that the Forest Service must hang tooth and nail to its traditional policy of keeping out exclusive privilege. The writer here and now pays his respects to the man who wrote into the Forest Manual the absolute prohibition of private game preserves. The larger part of the United States will be a private game preserve in 1940, and to extend this form of monopoly, inevitable on private lands, to the National Forests would be little short of a crime against democratic society. That the temptation will exist is evidenced by the pressure already brought to bear for fishing preserves on some of the western Forests.

Thirdly, it means that the Forest Service is directly interested in the system of differential State licenses as a regulator of the tide of hunters. Some well-intentioned sportsmen are advocating a flat license fee, applicable to residents and non-residents alike. They say it is not justice to discriminate between American citizens, especially as regards federally regulated migratory birds and federally owned National Forests. As a matter of fact, a non-resident license is not only justice, but common sense. It is a surtax on the man who can afford to travel out of his own State in search of hunting—that is, a surtax on the well-to-do. From the standpoint of the Forest Service, it is also plain self-preservation. A flat license at the present time would turn a flood of hunters into the Forests, under which our game in its present unproductive condition would simply collapse.

Fourthly, it means that as a fire hazard the National Forest hunter will occupy a position of increasing importance. This, of course, is no reason against developing the production of game, but rather a reason for better fire plans and more effective educational work among hunters. In any State without a live sportsmen's association, it would well repay the Forest Service to go out and organize one for this purpose alone. In New Mexico, for instance, the State Game Protective Association, organized largely by the Forest Service, will next fall paste on every box of shells sold in the State propaganda for care with fire and observance of the game laws.

Fifthly, it means that in those few places where game actually interferes with live stock, the question of meeting the future growth of demand for hunting must be intelligently considered in applying the principle of highest use. This by no means implies a wholesale exclusion of stock; on the contrary, it will generally mean that reliance will be had on species which do not interfere with stock, the production of which may be expanded without injury to other interests, and the relegation of troublesome species, such as elk, to National Parks and other regions where they can do no harm.

Sixthly, it means that it will be more than ever good business for the Forest Service to develop species on which it has a practical monopoly. These will prove especially attractive to hunters who will come from a distance. The mountain-sheep, the white goat, the ptarmigan, the Columbian blacktail, the wild turkey, the javelina, the fantail, the Crook's deer—all these will be worth ten times their weight in ordinary venison to the hunter from Iowa or Kansas who will come to seek respite from "No hunting, under penalty of the law."

THE STRUCTURE AND USE OF THE PARANÁ PINE FORESTS OF BRAZIL

(Contribution from the Yale School of Forestry, No. 3)

By H. N. Whitford

In the search for raw materials of lumber, the possibilities of tropical and subtropical forests have usually been overlooked. While the Paraná pine (*Araucaria braziliana*) region of southern Brazil has been mentioned as a probable source of lumber, its importance has not been sufficiently emphasized. This tree grows in commercial quantities in the plateau region of Paraná, Santa Catharina, Rio Grande do Sul. Small areas also occur in the States of Minas and São Paulo. While it has a botanical range of from 20° S. to 30° S. latitude, its commercial range is restricted mostly between the parallels of 22° S. and 27° S.

The three States mentioned above contain an area of some 575,000 square miles. According to the best reports available, 336,000 square miles of this area contains forest growth of some kind, of which more than 100,000 square miles is a conservative estimate of the area within which merchantable quantities of Paraná pine are found. Figures concerning the amount of timber within this area have never been made. One lumber company has under its control some six billion feet of the timber which will average 8,000 board feet per acre, including the blanks in the forest. Excluding such blanks, the average is near to 12,000 feet per acre. Some areas which I saw will produce as high as 25,000 board feet per acre. Many other parts of the region are broken by large areas of prairie and hardwood forests. To make allowance for these large blanks, reduce the area to 60,000 square miles and the amount per acre to 5,000 feet, and we have a stand of timber that is about two hundred billion feet. From what I saw of the region I should judge that fifty billion feet of this is accessible to present lines of transportation.

Botanically speaking, the Paraná pine does not occur in pure forests. Like many tropical and subtropical forests, its structure contains four fairly well defined stories. The upper story, or cap, is from 80 to 120 feet in height, composed entirely of Paraná pine. The third story contains trees 60 to 80 feet in height, composed mostly of 8 or 10 species of the family Lauraceæ, known in southern Brazil as the Canellas. One of these, known as Embuia (*Nectandra* sp.), comprises 50 or more

per cent of the stand of this story and nearly all of the present cut. Scattered specimens of a number of other species occur in this story, among which are Cedro (*Cedrela* sp.), a number of Leguminosæ, Bignoniaceæ, Myrtaceæ, and members of other familes. In places a palm gives a tropical tone to the story. The second story is composed of a large number of species which, when mature, will reach a height of between 30 and 60 feet, the composition of which is little known, though members of the Lauraceæ and Myrtaceæ seem to predominate. It is perhaps more complex than the third story. The first story, or base, is from 10 to 30 feet in height. A tree fern, a bamboo, and the famous Brazilian tea (*Ilex paraguensis*) are the characteristic trees of this story, but there are many others. Of course, in the lower stories there are immature trees of the story or stories above them. A botanical survey of the forest might show 50 or more species per acre, but the point to be made here is that the upper stories are simpler than those below them, and the top story contains only one species.

The above is the description of the forest where I had an opportunity to study it closely. Toward the north and northwest the composition changes. Gradually the hardwoods, represented usually by different species, become taller and the pines become shorter, until the tops of the pines and hardwood intermingle. Finally, the pines drop out altogether. To the south, as the drier regions of central Rio Grande are reached, the pine holds its relative position, though lower in stature; but some distance beyond its limits a hardwood forest, 50 to 70 feet in height, prevails, especially along streams. Finally, the prairie, or campos, is reached. So much for the structure of the forest. Let us now consider the extent to which these different stories are utilized.

Take the upper story first. In 1913 the estimated output of Paraná pine was about 60 million feet. From figures I collected the output has greatly increased, and today certainly reaches 150 million feet or more. This rapid increase is due in part to the normal growth of the lumber industry, but mostly because Brazil, Argentina, and Uruguay have been cut off from supplies of coniferous timbers from temperature regions, due to the war. Before the war these three countries in question used, in round numbers, 700 million feet of lumber, 500 million of which was imported from the United States and Europe, mostly southern yellow pine. To meet this demand, the total home production of both hardwoods and pine is estimated to have doubled, but still falls short by 300 million feet of the normal consumption. The greatest increase has been in the Paraná pine region, where the production has nearly trebled. It is known that if the railways had sufficient rolling stock to carry the output, the lumber industry of this region has de-

veloped sufficiently to cut one-third more than it is doing, and this, too, in spite of the fact that the industry has been also cut off from new milling and logging equipment. Most of the lumber companies cut only the pine, so that to them the forest is 100 per cent pure. The largest lumber company, and the only one well equipped with all modern and logging machinery, is cutting, annually, 40 million feet, or nearly one-quarter of the total amount produced. Ninety per cent of its cut is Paraná pine and 10 per cent is hardwoods of the third story, mostly Embuia (*Nectandra* sp.). Embuia is the timber de luxe of the four southern Brazil States. Like all tropical hardwoods that are durable, it is used alike for construction purposes, mostly railway ties, and for fine furniture and interior finish. The amount utilized each year is not known, but the railways of the States of Paraná and Santa Catharina consume annually 450,000 ties of Embuia for their maintenance. These last from fifteen to twenty years.

The second story is chiefly valuable for its firewood, though all other stories furnish more or less of it. The railways of the three southern States used, in 1917, about 1,000,000 cubic meters of firewood. The total consumption of firewood is estimated at 1,500,000 cubic meters. This is equivalent to about 400,000 cords of wood, most of which comes from the Paraná pine forest. Besides firewood, the large, conical-shaped resinous Paraná pine knots are a valuable source of fuel, especially for the railways, since, due to war conditions, imported coal has been cut off. The railways alone use some 48,000 cubic meters of these knots. One cord of pine knots or two cords of wood are the equivalent of one ton of coal. In all, the annual production of pine knots and firewood are equal in calorific power to more than 200,000 tons of coal.

The total production of wood products, including sawed lumber, fuel, and railway ties, amounted in 1917 to nearly 2,000,000 cubic meters, distributed as follows:

		Cubic meters
Lumber	150,000,000 board feet, or	350,000
Ties	800,000 (number), or	48,000
Firewood	400,000 cords, or	1,500,000
Pine knots		50,000
Total		1,948,000

The estimate of the value of the products delivered at the railroads is near to $5,000,000, distributed as follows:

Lumber	at $20 per 1,000 board feet	$3,000,000
Ties	at 75 cents each	600,000
Firewood	at 75 per cubic meter	1,015,000
Pine knots	at $2 per cubic meter	100,000
		$4,715,000

The most valuable product of the base story of the forest is the famous Brazilian or Paraguay tea (*Ilex paraguensis*). This small tree is botanically related to, and closely resembles in appearance, the southern holly of our country. In the virgin forest it is suppressed, and it is only when the forest is cleared of its underbrush and sometimes of all or a part of its second, third, and fourth story trees that it reaches full development. It seems to do best under the rather thin canopy of the Paraná pine. For small areas, it is the most valuable forest product of the region, for it is made to yield continuous crops of leaves. Sad to relate, it is the only forest product that is under management. Scattered throughout the lumbering region are farmers with small areas of the tea, or herva matte, as it is called locally, growing under the pine. So far I have obtained no reliable figures concerning the production of matte. There is authority for the statement that there are no less than 50,000,000 kilos consumed annually by the people of southern Brazil, Argentina, Uruguay, Paraguay, Chile, and parts of Peru and Bolivia. The largest part of this comes from the pine forests.

In the above I have attempted to describe briefly the forest and its present use. With the exception of the matte, the forest is being exploited without any regard to its conservation. The stumpage price is low, amounting to 50 cents per thousand board feet. All the accessible timber is in the hands of private owners, and is being cut or burned to make way for the cattlemen and the farmer. I am told, however, there are large inaccessible areas still under the control of the Government of the different States, and perhaps before this is opened by railways, the National or State governments will have taken steps to form National or State forests, to be lumbered with a view to their conservation rather than destruction.

There are reasons to believe that the Paraná pine region will play a rôle similar to that played by the white pine region of our Great Lakes. Like the white-pine region, the forests of Paraná pine lie to the northeast of a great prairie country that needs lumber for its development. Heretofore this prairie region has depended on coniferous woods of the North Temperate region, chiefly southern yellow pine. Today the greatest lumber-producing region in the world is the yellow-pine region of the southern part of the United States. With an estimated stand of 386 billion feet and an annual cut of 15 billion feet, it is yearly drawing on its forest capital. Is there any sane economic reason why this region should be called upon to carry timber thousands of miles to supply lumber to a region which has a forest at its back door containing 200 billion feet, or about one-half as much timber as the yellow-

pine region, and which is annually cutting only 150 million instead of 15,000 million feet, or one one-hundredth as much? While it might not be practicable, it would be in the interests of forest conservation of the United States if the Government would prohibit the exportation of pine to southern South America and induce some of the capital now invested in the lumbering industry of the southern States to be transferred to the Paraná pine region. This would mean capital sufficient to increase the cut at least to 500 million feet, the pre-war consumption of pine in the region. I am certain that if the Government would make such a prohibition, the lumbermen of the United States would soon learn of the immense profits that are being made by the lumber industry of the Paraná pine region and many of them would make a grand rush to get in on the ground floor.

SOME CAUSES OF CONFUSION IN PLANT NAMES

By Agnes Chase

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To plant breeders, horticulturists, ecologists, and other botanists not primarily systematists the changes made from time to time in the names of familiar plants is a source of confusion and irritation. There is a rather general impression in our day that want of uniformity in the use of names or change of names is a recent affliction due to the pernicious activity of certain botanists interested in nomenclature. But a comparison of contemporary botanical work of different countries any time during the last century will show that nonconformity in the use of names is no new thing. Successive editions of a standard work also often show the unsettled state of nomenclature during the whole period since the binomial system was accepted in 1753. And the old pre-Linnæan phrase names were so uncertain in their application that the confusion wrought by them was one of the main reasons for the ready acceptance of the Linnæan binomials. But to show that there always has been confusion as to the names of plants is not to argue that there always must be such confusion. Paradoxical as it may sound, it is the effort made during the last twenty years or so to bring about stability and uniformity in the use of names that has caused such a bewildering diversity.

Viewing the development of the science of botany since 1753, we find two principal causes for the confusion of names of which we are the heirs. First is the difference between the early and the present-day concept of a genus. The generic concept of the older botanists was an ideal made up of certain specified characters. The generic concept of botanists today is a group composed of related species. In the first case the genus depended on the generic characters assigned to it. In the second case the genus depends on its type species. In the first case the genus was supposed to be known when described; the characters given as generic were assumed to be common to all the species. In the second case inability to state with certainty which characters of a given species or group of species are generic is admitted; the genus is limited to a definite type species and its related species, whatever their char-

acters in common, known and as yet unknown, may be, and however one or more of these related species may depart from characters originally supposed to be generic. The earlier concept of a genus was from the viewpoint of special creation of each species; the present concept of a genus is from the viewpoint of the theory of evolution. The earlier concept may be compared to a box into which certain species were fitted. The box itself, as an ideal, existed independent of what might be put into it, as witness Endlicher's excellent generic descriptions with never a species mentioned. The later concept may be compared to a colony of coral still held together by an ancient common ancestry long since submerged. According to the earlier concept, a genus could be more definitely described than can most genera according to the later concept, but the species contained therein and conforming to the characters assigned to the genus might be heterogeneous. According to the later concept, characters assigned to a genus are accepted as a working hypothesis only and are changed or discarded as further investigations throw more light upon the subject. Species are assembled into genera according to the sum total of their morphological resemblances. If a given character hitherto regarded as generic is not common to such a related assemblage, or if it would bring together species which by their want of morphological resemblances do not show close relationship, this character is rejected as generic. Relationship to a definite species (the type) is, according to the later concept, the bond that holds a genus together. Hence, if the characters of one or two species deviate from those common to all the others, they may still be included in the genus if the sum total of their characters denote relationship. This later concept of a genus is both more fixed and more flexible than the earlier concept. Both are matters of human judgment, and the limits ascribed to a genus according to either concept varies as human judgments vary. But with a definite species as the basis of a genus, human judgments are more likely to be in accord than with an ideal set of characters as the basis of a genus. In most genera described in recent years a type species has been specified. But in the genera of older authors, working under the earlier concept of a genus, very rarely was a type designated. To adjust these older genera to the prevailing concept, it is necessary to choose a type species. This is often difficult because many genera of the earlier authors, especially those of Linnæus, are made up of very diverse species. The genus *Pinus* of Linnæus, for example, contained ten species, of which but five belong to the genus *Pinus* as limited today. The other species belong to the firs, spruces, and larches, and one is the cedar of Lebanon.

Panicum of Linnæus contained such diverse grasses as pearl millet, common millet, barnyard grass, *Paspalum,* St. Lucie grass (*Stenotaphrum*), crabgrass, *Opilismenus,* and Bermuda grass, besides the group now called *Panicum.* His *Holcus* contained sorghum and Johnson grass, velvet grass, holy grass, or vanilla grass, a species of *Uniola,* and one of *Sacciolepis.* The generic names given to such heterogeneous groups were subsequently differently applied by different authors, according to which of the diverse elements they applied it. Today botanists are striving to formulate reasonable rules to govern the choice of the types of such genera, so that the generic names may be permanently fixed. This is the most difficult problem which nomenclatorial rules aim to solve.

The second cause of the confusion in names was the relative isolation of the different workers. A few industrious compilers like Roemer and Schultes for a time sought to bring together the new genera and species, ever increasing in number as the result of scientific voyages and exploring expeditions. Their attempts at co-ordination sometimes wrought confusion because their work was based largely on literature and not on the plants. There was a short-lived Neue Entdekungen fur Pflanzenkünde in the early nineteenth century, and a Botanischer Zeitschrift later, that attempted to review current botanical literature, but these could do little in so rapidly growing a field. Ignorant of each other's work, men in different countries often described the same genus under different names, or various authors hit upon the same word in naming diverse genera or in naming different species in the same genus. The name *Elodea,* for example, was given to a common water-weed and to the pretty pink-flowered ally of the St. Johnsworts; a lichen and a grass were both called *Setaria.* In the third and fourth decades of the last century, another industrious compiler, Steudel, prepared a Nomenclator Botanicus, which, while faulty, must have been a most useful work, being an index to the place of publication of plant names, generic and specific. But the second (and last) edition of this was issued in 1840 and 1841. It is Darwin who, impressed with the need of such work, left funds for its compilation, that we have to thank for the Index Kewensis. Darwin's original idea, so his son tells us in the "Life and Letters," was a nomenclator simply. The plan of attempting to pass upon the validity of genera and species and of referring them to synonymy developed at Kew as the work proceeded. This attempt to establish names by fiat for awhile added to confusion, for there was a tendency when the index first appeared to accept its fiat. Most middle-aged systematists today can recall the shock they sustained when

they first realized that when the Kew Index said such a species equaled such other species it was not necessarily so. For all its shortcomings, however, the Index Kewensis, with its successive supplements, affords an invaluable index to names and places of publication (its references to synonymy may be disregarded), and serves more than any other one thing to make possible serious work looking toward a final uniformity and stability of nomenclature, so far as that is humanly possible of attainment.

Until about twenty-five years ago there had been no concerted effort to bring about conformity in nomenclature. A center of great botanical activity, like Kew, rather expected its usage to be followed out of respect for authority, and it was so followed in the United States. Paris and Berlin, the other great centers of activity, went their separate ways.

The need of reform at last became so pressing that several botanical revolutions broke out, each bent on establishing a "stable nomenclature." At about the same time there was published the Pflanzenfamilien, by Engler and Prantl, which gave the families and genera in a new order, beginning with the most simply organized plants and ending with the most highly specialized, expressing, so far as possible in a lineal sequence, the evolution of plant life. This sequence agreed with the current viewpoint so much better than that followed by Bentham and Hooker in their Genera Plantarum, which began with Ranunculaceæ, ascended to Compositæ, and then descended again to sedges and grasses, that it found wide acceptance and gave advantage to the nomenclature used. There was a fairly general desire to base nomenclature upon priority. The Engler and Prantl, or Berlin, nomenclature was based on priority, with, however, a good many exceptions (most of these exceptions were later embodied in the list of Nomina Conservanda of the Vienna Code—that is, names to be conserved, regardless of priority); but many botanists believed that only by a strict adherence to priority could stability be attained. Another source of nomenclatorial diversity was the idea of basing each genus on a type species. This was America's contribution to the problem, and though it has brought about some troublesome changes of name, such as the restoration of the name *Holcus* to the sorghums, it, together with adherence to priority, promises to be the means of bringing about eventually a uniform nomenclature, so far as that is humanly possible.

ECONOMIC ASPECTS OF THE WOOD-FUEL CAMPAIGN

By A. F. Hawes

U. S. Fuel Administration

The campaign to produce wood as an emergency fuel to relieve the coal situation during the war was, on the whole, a success. Like many other activities connected with the war, its benefits would have been more apparent had the war lasted longer. It is safe to say that the greatest advantage derived has been the awakening of the general public to the importance of wood as a fuel and the vast resources of the country in this form of fuel. Communities long unaccustomed to burn wood have learned to use it, and many householders have found it an economy to heat their houses with temporary wood fires during mild weather, even at the prevailing high prices for wood, rather than use coal. Many people have formed a habit of providing themselves with a reserve of wood fuel which should be of lasting benefit.

It is extremely difficult to form any estimate of the increased amount of wood used as a result of the campaign, because it has varied so much in different sections. The question also arises as to whether the result should be compared with the amount burned in a normal peace year or with the amounts which would have been burned under war conditions had no campaign been instituted. As compared with normal consumption, it is doubtful whether northern New England, for example, increased its consumption of wood, since the scarcity of labor tended to offset the efforts of the Administration. In Massachusetts and Rhode Island, on the other hand, the consumption of wood was probably increased 100 per cent, while in York County, Pennsylvania, the fuel administrator estimates that it was increased 500 per cent. The total amount of firewood consumed in the country in a normal year is about 100,000,000 cords, or about one cord per capita. Allowing 1½ cords as the equivalent of one ton of coal, either bituminous or anthracite, this means the replacement of 66,666,000 tons of coal. As compared to an annual total consumption of 500,000,000 tons of coal, this is not a large figure. But as most of the wood is used for domestic purposes, it is in competition only with the 110,000,000 tons of coal used domestically. On the whole, it seems conservative to estimate that the consumption of wood was increased at least 10 per cent, which would amount to 10,000,000 cords, and would represent a saving of

7,500,000 tons of coal, or about 7 per cent of the coal used domestically. The chief difficulty in stimulating the demand for wood was the unprecedented high price asked for it in all parts of the East. This was, of course, due to the scarcity of labor, and was largely justified by the cost of production, but the feeling was prevalent that there must be a good deal of profiteering in the wood business. The Lever law, under which the Fuel Administration was organized and which provided for fixing the prices of coal, did not authorize the fixing of wood prices. By many this was considered a serious objection to a wood campaign. The writer has felt from the first that the best way to regulate the price of wood was to stimulate its production and increase competition among sellers. Experience has shown that the old law of "supply and demand" is a safe one to tie to. The experience of New Haven, Connecticut, illustrates this point very nicely. The campaign was organized there for the Fuel Administration under the direction of Professor Hawley, of the forest school. In place of the 15 to 20 dealers who were formerly selling wood in this city there are now (Jan., 1919) from 25 to 40 dealers. Many of these men have only recently acquired gasoline mills and gone into the business. Prices of stove wood have dropped from $2 to $4 a cord, partly owing to the improved coal situation and partly to the greater competition among wood dealers. Thirteen of these dealers carried advertisements in one evening paper. Prices mentioned for hardwood in stove lengths were: $10, $11, $12, and $12.50. The consumers' interests had further been safeguarded by the establishment, in agreement with the dealers, of a standard cord of stove wood. Previously there had been no standard. Consumers had supposed that they were buying 128 cubic feet of stacked wood for a cord. On the other hand, dealers had claimed that a cord of stove wood was the amount of wood sawed from 128 cubic feet of 4-foot wood, but in many cases it was measured only roughly as thrown into the wagon. The Fuel Administration after careful investigation adopted 90 cubic feet of stacked stove wood as a standard cord. This is slightly more than has been commonly given. The campaign throughout Connecticut has resulted in the small towns stocking up with wood to such an extent that the coal situation in the cities would have been materially relieved had the war continued. In the same way it is estimated that wood production in Rhode Island was increased about 100 per cent.

In contrast to this encouraging experience in New England, an unfortunate condition existed in Virginia at the time of the signing of the armistice. During the summer of 1918 Mr. Montague, of the Fuel Administration, organized an efficient campaign for stimulating the

production of wood by the farmers throughout the State. By agreement with him, the dealers in Richmond and Norfolk guaranteed to pay the farmers $9 per cord for 4-foot wood delivered in these cities. A plan was further worked out with the banks of the State to finance the farmers in their operations. A portion of the Fuel Administrator's letter to the farmers is quoted below.

"The majority of owners of wood, on the stump, throughout Virginia recognize the call on them to turn their forest trees into needed fuel. Only a comparative few, however, have at their command the outlay of ready money required to cut, haul, and season this wood, and they must have the assurance of a ready sale for their prepared wood at a price that will cover expenses and allow a reasonable profit for their work. To cover the many cases in which the owners of standing timber and wood, who are willing and desirous of turning same into prepared wood, but are unable to finance the cutting, hauling, and seasoning of this wood, the following plan will render effective and immediate assistance.

"A contract drawn as per the sample copy enclosed, taken to a bank or financial institution, by the owner of stumpage, deposited attached to collateral note, as per enclosed sample copy No. 2, will, in cases where the responsibility and good name of the producer are not questioned, enable the producer to borrow from the bank or financial institution the amount of money necessary for the actual cost of cutting and hauling the wood.

"By this plan thousands of cords of wood will be obtainable that otherwise would remain as forest.

"We have a big task in Virginia to convert our forest resources into prepared fuel, and have same accessible to the consumer, and a short time to accomplish this task. It must be done."

The Fuel Administration in making this proposition to the farmers also offered to assist the dealers in finding plenty of wood, and agreed that $14 was a fair price for the dealers to charge for stove wood, delivered to the householders. Under this arrangement the items of cost are estimated as follows:

Stumpage	$1.50	
Cutting	2.50	
Hauling	2.00	
Wholesalers' gross profit	1.00	
		$7.00
Freight	$2.00	
Unloading and storing	.50	
Sawing	1.00	
Delivering	2.00	
Retail profit, overhead, and shrinkage	1.50	
		7.00
		$14.00

The above arrangement would undoubtedly have produced the necessary amounts of wood for the cities of Richmond and Norfolk, which was estimated as 100,000 cords. Unfortunately, complaint was made

to the State Council of Defense that the retail price of $14 was too high, and the council announced that it would supply the householders with wood at $9. This immediately upset the previous program, as the dealers stopped buying wood and the farmers stopped producing it. The Council of Defense undertook a cordwood operation on a tract which had been cleared of its forest growth for a Government powder bagging plant, and has been able to deliver a considerable amount of wood. However, had not the armistice resulted in a plantiful supply of coal, it is evident that there would have been a serious situation as a result of this interference with the plan of production by farmers. In other words, production can only be stimulated by an attractive price, and the consumers' interests are better served in the long run by stimulating production than by fixing the price.

It may appear, at first glance, that the plan of the State Council of Defense to cut and sell wood in Richmond was in line with the plan advocated by the Forest Service to develop municipal wood yards. Several of these were successfully operated in the South, but for the most part they have relied upon the farmers to produce the wood. In fact, the main purpose of a municipal wood yard was to guarantee a price sufficiently high to stimulate production by private operators.

The municipal wood yard was most generally adopted in North Carolina. A somewhat different plan was adopted in the Tennessee towns, where local war fuel companies were organized. These are stock companies made up of public-spirited citizens as stockholders, operating under a charter duly registered with the State. The officers serve without pay and the profits are limited to 6 per cent, as the object is entirely to alleviate the fuel situation. In some of the northern cities, notably Worcester, Mass., the Chamber of Commerce undertook to furnish wood by advancing funds. In this case the special object was to provide the industries of Worcester with an emergency fuel. Several concerns were saved from closing by these measures, and although their fuel costs were much higher than usual, they found that they could burn wood satisfactorily, and there was no interruption in the carrying out of the war contracts, which would otherwise have been the case.

The wood-fuel campaign served its main purpose of relieving the coal shortage with wood. It has not brought about any better handling of the woodlots, as was possible with the high prices obtaining for inferior wood. It seems to the writer that there is an undeveloped opportunity to encourage forestry through the public wood yard, but that the best results could be brought about through some modification of the Tennessee plan, whereby the stockholders were pledged to the advancement of forestry in the surrounding country as well as the sale of wood at

a reasonable price. I would suggest that such a company offer two prices for the same grade of wood—the normal price for wood cut clean and an advance price (perhaps 50 cents higher) for wood cut under methods approved by the State forester or some other approved forestry authority. All wood would be pooled and sold to the consumer at a uniform price, since he does not have the interest in the improvement of the forest which the community has, and, theoretically, does not care how the wood is cut. The increased price should be suffiicient to cover the extra cost of cutting under the selection or other method of silviculture.

Much has been written during the past few years advocating municipal forests for this country and citing the experience of European cities. It is extremely difficult to overcome the well-known American prejudice against public ownership and so-called socialism. Little progress has been made thus far in this line. The wood-fuel campaign of the war furnishes a further argument for such forests as reserves of wood fuel. It should be easy to make the people of Worcester, Mass., and other towns which have suffered for lack of coal, see the advisability of having close at hand a large supply of fuel which can be obtained by team and auto-truck without burdening the railroads. A coal shortage may occur at any time, due to a strike of the miners or the railroad employees or to a serious epidemic like the flu or to other unforeseen causes.

In addition to the attempt to establish the contents of a cord of stove wood, as mentioned above, several States have made progress in classifying fuel wood. The following simple classification established by the fuel administration for New Hampshire may serve as an example:

Quality 1.—All good-sized cleft hardwoods of beech, maple, yellow and white birch, with smaller quantities of hickory, ash, and oak. Some very large cleft limbs would not be objectionable in this grade.

Quality 2.—Partly cleft and partly limb wood, all of hardwood species, mostly of the better kinds of hardwood, but with some good-sized soft maple and chestnut. No softwood.

Quality 3.—Mostly limbwood of all species, with some softwood.

The permanent benefits which should result from the wood-fuel campaign may be briefly summarized as follows:

1. An increased burning of wood and a more general interest in the woodland as a source of fuel.
2. The establishment of standards for the measurement and classification of wood.
3. The creation of co-operative wood markets.
4. Furnishing a new argument for municipal forests.

SOME REMARKS ON STATE FOREST POLICY [1]

By Ralph S. Hosmer

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What I have to say concerns itself with the definite enunciation of forest policies in State work. It has been my experience that the importance of this point has been minimized. I am arguing that greater stress be laid on it. I shall attempt to show that certain distinct advantages are to be gained thereby.

It may be regarded as axiomatic that to attain the largest measure of success in the forestry work of any State there is required behind the State officials a strong public sentiment. Very briefly, I wish to discuss certain ways in which such a sentiment can be promoted and maintained. The people support that which they understand and are interested in. Consequently a part of the problem of State forestry becomes one of education, especially through popular channels.

The first requirement, naturally, is that there be a solid foundation. In no State can public forestry work be permanently successful unless it be based on well-considered ideals, sought to be put into practice by an efficient organization. From the experience of the past 25 years, there is pretty general accord in the minds of American foresters as to what constitutes good organization in State forest work. Many forms have been tried out, with varying results. The most satisfactory solution seems to be control by a small, non-salaried board, preferably made up of representatives of the interests in the State that have most to do with forests, under which serve technically trained men, protected by the regulations of a civil service. We do not need here to consider that aspect. The point to which I would direct attention is the need for a better formulation of the forest policy of the State, and especially the definite enunciation of such a policy. Most of the States having forestry departments have a comprehensive enough program, but few of them have made the things for which they stand so clear that he who runs may read.

The fundamental forestry law of a State should, of course, contain a broad statement of principles, and from time to time the State for-

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[1] Prepared to be read before the Society of American Foresters at its annual meeting, at Baltimore, Md., December 27, 1918.

ester, or other recognized spokesman, should explain in more or less detail what it is he proposes or wishes to do. But in few States can one find easily and in one place a statement of all the important things in forestry for which that State stands. If one is reasonably familiar with the situation, it is not perhaps very difficult to get this information together. But in many States it has to be compiled from a speech here, an interview there, or indirectly from references in an annual report to past or current work.

My contention is that it would be to the distinct advantage of any State to issue in liberal number and to distribute freely a brief summary of the points in its forest policy which the State officials regard as significant, perhaps backed up in a few words by the reasons why. Such a statement would go a long way to clarify what now is often an obscure situation. The general public, and even the man who has some interest in forestry, has little time and less inclination to search for this information. But if in 12 to 16 pages he can find, quickly and accurately, what he wants to know, his interest tends to increase and often his active support is secured.

State forest policies are naturally subject to revision with change of time. New happenings bring in new issues and require readjustments. It is not to be expected or desired that the policy of any State will be fixed on all points once and for all. Like a good working plan, a State's forest policy should be subject to periodic revision. But if at any given time one wishes to know easily and quickly just where the State Forestry Department stands, it seems to me that he should be able to get that information without recourse to correspondence.

The definite enunciation of a policy has certain concrete advantages. First, it clarifies the minds of the men who draw it up and centers their attention on the points of most importance. It stands thereafter until revised as a guide to themselves, and especially to their subordinates. It strengthens the *esprit de corps* of any organization if every member feels that he is one of a team working toward perfectly known and well-understood ideals.

Second, a statement of policy tends toward continuity of effort in a given direction and strengthens the hands of those whose duty it is to carry out programs extending over many years. Forestry projects are necessarily often of long duration. It is desirable, when after careful study such projects have been adopted and put into effect, that they be not interfered with or disturbed. One of the strong features about a continuing board of control is that the slowly changing personnel tends to prevent sudden departure from established usage. Further, and

more important, the endorsement and continuation of a given policy by several successive boards or single commissioners or State foresters gives that part of the general program a standing from which it cannot lightly be dislodged. This fixing of a policy reacts beneficially in several ways. It tends to delay hasty action on the part of new appointees. Even should there be a general overturn of the State forester's staff, it would be a rash politician who would dare upset offhand a policy (for example, the acquisition of State forests) to which, with the approval of the people, the State had been definitely committed over a period of years. In the same connection, the fact that the people of the State generally knew just what the forestry policies were would cause them to be more on their guard should the likelihood of hostility to the State's forest policies seem imminent on the part of a new governor or legislature.

A third reason is that the portion of the public that is interested in forestry would often be glad, or could easily be induced to give better support to a given program or project if they thoroughly understood its bearing and relation to the fundamental aims of the State's forest work. A clear statement of what those aims were would be accessible to every one were such a publication as that indicated available and readily to be had.

Especially important is it at this particular time that there should be a clear understanding with regard to all questions of vital interest to the people. Never were men's minds more open to seek wise solutions of problems, social and economic. To the forestry profession, which in America has always stood for a frank discussion of all matters relating to forestry and to conservation, this reconstruction period is a time unusually opportune for re-emphasizing the basic need to the people of forestry and forest work. It is an era in which many things are to be weighed in the balance. State forestry officials have no reason to fear the searchlight. On the contrary, this is the time above all others when the people should be made aware of what forestry means and is. If a State's forestry policy is already well known, it will do no harm to reaffirm it. If it has never been stated succinctly, let the officials of that State respond promptly to the knock of opportunity. It may not be sounded again.

A fourth and final reason why it is desirable that the forest policy of a State be clearly outlined is because of its bearing on the relation between the State forester and the State forestry association.

Organized as most of our State forest services are, there are certain kinds of work pertaining to forestry that can better be done by a quasi-

public association than by the State forester's office. The State forester should be closely affiliated with the State forestry association and should co-operate cordially with it. But it is better for many reasons if he does not take too prominent a part in its activities. The forestry association or its equivalent—and there are in the different States many organizations that often make unnecessary a definite forestry association—is in a better position than any other agency to exert a beneficial influence on forestry legislation and to help to press or to retard bills that are favored or opposed, as the case may be, by the State forester's office. In certain phases of publicity or information service work the forestry association, too, can exert a powerful influence and often reach persons whom the State forester cannot. Further, in some States, the forestry association can sometimes undertake definite lines of forest or kindred work that need to be done, but which from lack of funds or for other reasons do not fall within the scope of the State forester's activities. The time when general propaganda was a necessity has passed in certain regions of this country; elsewhere it still seems necessary to continue to impart elementary truths. But it will be a long while yet before the need ceases for a better understanding by the general public of what forestry really seeks to accomplish and of how forestry and conservation measures can best be promoted. This is essentially the field of the State forestry association. Rightly carried on, such an organization can do yeoman service in holding up the hands of the workers in the profession.

I do not need here to enter into that other phase of the question—the moral support that a properly run State forestry association can give to a State forester who is hampered in his work by self-seeking political opposition. One has only to recall the cases in recent years of two New England States, where in the one instance the situation was saved because of the help of the forestry association; in the other where it was lost, because although public opinion throughout the State was probably in the State forester's favor it was not properly organized and hence was ineffective.

The whole point in this relation between the forester and the forestry association in a State is that to obtain the best results for all concerned, and with especial regard to the ultimate best interests of all the people, it is highly desirable that the co-operation between the forester and the association be close and cordial. A good approach is complete mutual understanding. On the part of the forester, how can this be better accomplished than through a clear and comprehensive statement of policy?

Summarized, the points made in the above argument are: That to secure the best permanent results in public forestry in any State there is needed a strong public sentiment. To help in securing such a sentiment a definite enunciation of policy goes a long way. Further, this is of advantage because it does four particular things, to wit: (1) It clarifies the situation and provides a definite working plan for the State's forestry work; (2) it tends to establish continuity of effort in a given direction and to guard against the upsetting of the forestry policy by political or other enemies; (3) it is one of the most helpful bases on which to rest a campaign of rightly directed publicity—a matter of especial importance during the present reconstruction period; and (4) because it forms a good bond of connection between the State forester's office and the State forestry association.

An enunciation of State forest policy does not have to go into great detail; indeed, it is better if it does not do so. But there is, in my judgment, a greater need than has been realized of having in every State a clear and definite summary of the big, broad issues that are involved.

PLANTING IN RELATION TO THE FUTURE OF NATIONAL FORESTS

By Fred R. Johnson

Forest Examiner, U. S. Forest Service

We wish to discuss a phase of the grazing policy on the National Forests as influenced by the present war, which, when combined with some natural consequences following the war, may react to work a possible injury to our National Forests; and also how an effective planting policy may have much to do with offsetting this threatened danger.

In 1917, in an effort to make the National Forests play a helpful part in winning the war, increases were allowed in the grazing authorizations of the various Forests of 200,000 sheep and 100,000 cattle. It was announced that the Secretary of Agriculture felt that it was necessary to take some chance of overgrazing in the interest of large immediate production. In 1918 this policy was further continued and 188,000 head of cattle and 876,000 sheep were grazed over and above the 1917 figures. This is pleasing in a number of ways:

(1) It makes us feel that the National Forests have been of some material assistance in providing forage for the much larger herds that are necessary if we expect to furnish the additional food for starving Europe in accordance with the plans of the Food Administration.

(2) It materially increases our receipts and helps to bring the organization nearer the desired self-supporting basis.

On the other hand, are not the dangers from a policy of this kind much greater than any possible benefit to be derived from overcrowding the Forests with stock without making adequate investigations to determine the damage that is being done to the natural forest growth? There is no need in this article to discuss the effort that is already being made by stockmen to have their "temporary emergency permits" made permanent on the grounds that since the range has carried the increased number for two seasons it can carry them indefinitely, nor of the tendency on the part of supervisors to forget the silvicultural viewpoint and look upon their Forests as big ranges. The Forester has foreseen this very danger and has sounded a word of warning.

This matter of temporary increases is not the danger, as I see it, so

much as the grazing idea that has been instilled into the heads of our men. It is natural for the average ranger to be more interested in the grazing business than to the division of his entire district into working circles with definite plans of management and rotations, such as our forestry regiments found in France. But it is surprising to read in planting reports and to have advanced to you by men who have had forestry educations the argument that planting should not be done on certain areas because they are now bringing in more revenue and doing more good in the production of beef than they could possibly do by their change from a light aspen stand, valuable for grazing, to the characteristic lodgepole type having small forage value and not producing any revenue for 150 to 200 years and possibly inaccessible for logging. These men have forgotten the reasons for the creation of the National Forests—timber production and water conservation. They do not have the vision of the French foresters who planted a century ago the trees that helped so much to defeat the enemy today. Areas which from the present logging viewpoint are inaccessible and represent minus values will be the storehouses of the future.

But I am not attempting to show that the present grazing policy is injurious to the best silvicultural development of our Forests. In the Rocky Mountain District of the Forest Service it can safely be said that sufficient investigation has not been made to prove or disprove this point, although in justice to the branch of Research it may be stated that several projects of this character proposed by this office have been eliminated from the general program of investigations. The solution of some of these problems should now be effected by the closer cooperation of the branches of Grazing and Silviculture, as planned in the recently announced policy of the Forester.

But this grazing policy has a bearing upon a larger movement into which we are just now coming. It is a known fact in our history that after each of our big wars in this country there has been a movement to the soil. Men who prior to the war had indoor positions will have become so accustomed to life in the open that their former jobs will be intolerable; the war will also have created in many boys, some of whom prior to the time they were drafted never had been more than fifty miles from their homes, the spirit of "wunderlust." To meet this spirit, we have a grateful Congress or scheming politicians providing ways and means for the soldiers to acquire homesteads under easy terms. Already the Department of Interior has announced proposed plans for making available more homes for the soldiers. But most of the public domain now open consists of desert land, cut-over land, or swamps.

Large areas have recently been opened under the grazing homestead law and as rapidly entered. The National Forests in one district alone contain about six million acres of grassland, sagebrush, land above timberline, etc. Is there any reason for supposing that the prospective homesteader, the politician, and the agitator will not point with greedy hands to the large grazing areas within the National Forests and ask why this land, similar in character to the grazing homesteads, should not also be opened to entry? They will point to the fact that the National Forests have as advantages over the average grazing homestead water and timber; they will point to the increased number of stock that have been grazed on the Forest ranges during the past few years, which demonstrates clearly the grazing character of the land and makes it compare very favorably with the average grazing homestead. You may doubt the value of the grazing homesteads and state that this land will eventually pass into the hands of stockmen, but this will not be apparent for some years and not before the threatened danger to the National Forests is likely to appear.

During this period the Forest Service will be upon the defensive and a clear and definite policy will be necessary in order for the Service to retain its areas intact. The necessity for retaining scattered areas of grassland for administrative reasons in connection with the management of adjacent timber lands is of little force to the general public. The argument that certain areas are potentially forest lands and necessary to the management of a certain unit loses its value when these areas of sagebrush or grassland are continued year after year as ranges and no effort is made to afforest or reforest them, as the case may be. To this the reply is made that all the Forests have been thoroughly classified in accordance with the existing law, and that we simply need to produce our classification reports and show that the land is more valuable for forestry than it is for agriculture or grazing. Undoubtedly the classification reports answer the purpose in segregating arable land from true forest land, as we know agriculture development at present. But I contend that our classification reports are not infallible, particularly with respect to the present policy of developing public lands to their highest use, as expressed by Congress in the grazing homestead bill. That Congress has not looked with favor upon the inclusion of purely grazing land within the Forests or their administration separately under lease to stockmen is evident by their turning down proposed legislation of this kind. This being the national policy, why should we not expect attacks upon the classifications of the National Forests if the large grazing areas within these Forests, having a poten-

tial forest value, are not devoted to the use for which they were set aside?

Sympathy for the returned soldier, or the political advantage to be gained by some congressman or group of congressmen, or party, in winning the favor of the large soldier vote will probably have considerable influence in the passage of future land legislation. That legislation of this character is successful is demonstrated by the creation of National Parks continually from National Forests, regardless of national needs, the influence of the congressional delegation often being the determining feature rather than the merit of the project. The attack has already started upon the organization and it is up to us to have our line of defense clearly prepared.

It seems to me that a vigorous planting policy upon non-timbered lands within our National Forests will assist greatly in meeting the present situation. Never before have the people of the United States had the needs of forestry impressed upon them so much as during the present period. The discovery that our supplies of black walnut, black locust, and accessible spruce were almost exhausted came as a shock to the people of the United States. The knowledge that France had been practicing forestry for over a century and had thus acquired forests which helped to shorten the road to victory has stimulated the interest of the people in forestry. We even have the National Council of Defense urging the planting of walnut, hickory, and other species of forest trees. This indicates that the nation as a whole would be prepared for any expansion in our planting program. Extensive planting of this kind will remove the objection that some lands are being held for grazing purposes and will indicate that we were consistent in including certain lands within National Forests on account of their potential forest values.

Of course, it will be impossible to start planting extensively at once without some investigation and some plans. From successful plantings we have data for numerous regions, indicating the proper methods and species to use, and for other areas the data which we had hoped to secure through ranger planting was rendered valueless by the trampling of cattle. It is true that many of these failures were due to careless selections of planting sites, often the small plots being located in places convenient to the ranger station, but on sites unfavorable for tree growth. The present planting policy calls for the forestation of the most favorable areas first, with intensive experimentation on the more vigorous sites before large operations are commenced there. It

has just been announced that a commission, which has been investigating the forestry situation in England, has recommended that 1,000,000 acres be reforested and has formulated definite plans for the work. Even battle-worn France several months ago requested 1,000 pounds of Douglas-fir seed for reforestation purposes, which indicates the importance she places upon perpetuating her forests. The point is that it will not be necessary to start in immediately upon extensive planting operations, provided we at once formulate our policy, draw up our plans, and announce them to the public.

During the meantime investigations covering a wide range of conditions from the effect of grazing upon reproduction in various types to the proper species and methods of planting can be started, and if necessary a start can be made upon the reduction of grazing in accordance with the Forester's announced policy "that grazing must give way to forestry when there is a conflict." We recognize that grazing has a certain value in the present forest and undoubtedly will have, to a less extent, in the future fully stocked stand in the protection it affords through the use of luxuriant forage crops. There will be also certain minor types which possibly will be permanently valuable principally for grazing, including wet parks and willow lands. But many of these points are of uncertain status and it is our duty to determine the correct use of all lands.

Let us preserve the integrity of our present forests, which we have been reducing and compacting during the past ten years until it would seem that a halt must be called if we would have anything left but rock slides and land above timberline. Let us put them to their proper use in the practice of forestry and water protection and subordinate grazing to its proper place, which must be determined by thorough investigation. Let us formulate a definite planting policy that will finally establish a forest cover on the large treeless areas within our boundaries, thus increasing the water-storing capacity of our Forests, so that more desert lands may be reclaimed, and providing timber for the future, when our present supplies will long since have been exhausted.

THE TIMBER CENSUS IN THE NORTHEASTERN STATES[1]

By A. B. Recknagel

Shortly before the Germans launched their drive on the vernal equinox, which, as far as they were concerned, ended in a winter solstice known as an "armistice," certain members of the War Committee of the Society of American Foresters foregathered in the New York office of R. S. Kellogg and planned another drive which, it is hoped, will result far more favorably.

The objective was nothing less than a timber census of the Northeastern States, and, to be precise, the meeting was held on April 25, 1918. Those present represented the States of Maine and New York, and a plan of campaign was developed for securing the desired data. The chairman of the War Committee, Professor Toumey, of Yale, was unable to attend, but shouldered the burdens of securing the needed data for the States of Massachusetts, Rhode Island, Connecticut, New Hampshire, and Vermont by enlisting the co-operation of various organizations in these States.

The campaign developed rapidly and met with an unexpected degree of support on the part of timberland owners. Forms for reporting estimates were prepared and sent out in each State by some recognized agency. In New York, Mr. C. R. Pettis, Superintendent of State Forests, and myself, under date of May 15, sent out the following letter, which may be considered typical:

> "The undersigned request your careful attention to the enclosed form. There is urgent need for reliable information about merchantable standing timber to meet the inquiries of the Federal Government as to available sources of supply for war industries.
>
> "The information obtained from you will be kept strictly confidential and no one will see the figures who has any pecuniary interest involved.
>
> "Your co-operation in this undertaking is necessary for its success. Please give the information immediately in order that statistics may be tabulated and completed in time to help the Government."

What followed up to the ending of the war has been told by Professor Toumey in the November issue of the Journal, so that there is no need to repeat.

[1] Read by I. C. Williams before the Society of American Foresters at its annual meeting, at Baltimore, Md., December 27, 1918.

On the day following the signing of the armistice, the "census makers" gathered in Boston and, with the joyous shouts of the peace revel in their ears, decided that despite the end of the war the valuable data accumulated in the census should not be lost, but that the work should be carried to completion. It was left to each State to compile the data and to publish them through whatever agency in the State seemed most appropriate. Then the Forest Service will probably publish a summary for the entire Northeastern region.

So the matter stands at present. Conceived as a piece of war work, the timber census gives promise of filling a peace need as well. Witness the following resolution adopted at the Reconstruction Conference of the National Lumber Manufacturers' Association in Chicago on November 23:

"WHEREAS, A census of standing timber classified by species, quality, location, and accessibility—a census of cut-over lands that will remain temporarily or permanently in forest would secure to the lumber industry information important in the conduct of its business; and

"WHEREAS, Such a census would afford a basis for the interpretation of economic problems in forest and wood-using industries; and

"WHEREAS, Such a census would greatly aid the development of a permanent national forest policy, with respect to timber ownership, lumber export, tariff, local taxation, value of stumpage, and sundry forest problems;

"THEREFORE, First. The National Lumber Manufacturers' Association heartily endorses the proposal that the Bureau of the Census with the Forest Service undertake such census;

"Second. To this end the association offers its facilities to the Bureau of the Census and the Forest Service;

"Third. The association urges Congress to make adequate appropriation to make such census complete and comprehensive."

I would like to cite one practical result of the timber census. Only a few months ago the country was being scoured for aircraft spruce. "How much spruce have you?" was a burning question. The answers varied. U. S. Dept. of Agric. Bul. 544, The Red Spruce (Oct., 1917), gave a total of 13,300,000 M feet board measure of spruce in New York State. Many of us were skeptical that so much spruce remained. Mr. K. M. Clark, of the Forest Service, in a report on airplane spruce supplies (June, 1918) estimated the total standing spruce in New York State at 4,000,000 M feet. The Forest Service (Sept., 1918) revised its estimate to 2,869 M feet—a difference of 10 billion feet in less than a year! The census has shown that there are actually about 3½ billion feet, board measure, of standing spruce in New York State.

REVIEWS

Logging in the Douglas Fir Region. By W. H. Gibbons. Bull. 711, U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1918. Pp. 256.

A person undertaking to write a volume describing the logging industry of the Pacific Northwest is confronted with an immense mass of details and a ramification of methods which renders the full presentation in a readable form exceedingly difficult. The author of the bulletin, however, in his preface, frankly states that "the subject is broad in scope, and only the more important features of Douglas fir sawlog operation, as a rule, are covered." The first portion of the bulletin is devoted to a brief description of several very important matters connected with the logging industry, such as the organization of Pacific Coast logging operations, labor and wages, camps, workingmen's compensation acts, taxation, scaling and grading, accounting, and log prices. There then ensues a detailed description of the various steps involved in converting the standing tree into logs and transporting the logs to the sawmill. Falling, bucking, yarding, loading, railroad transportation, unloading, rafting, and towing are discussed in detail in the order in which they take place in the woods. Much of this information has been secured from the Proceedings of the Pacific Logging Congress and various Pacific Coast lumber trade journals, but the bulletin is none the less valuable, as it, for the first time, sets forth in a logical printed form a complete survey of the industry as carried on in the Pacific Northwest.

The author is to be complimented on the freedom from inaccuracies that have appeared in some other publications dealing with the logging industry which have been written by men not intimately connected with the industry. Two exceptions to this statement were noted. At one point a diagram shows ground yarding roads radiating out from the landings, whereas in practice they radiate from a lead block attached to stumps located a convenient distance on either side of the landing. In another place the salary of a logging engineer is listed at $100 to $125, which is just the same rate as given for the scaler and bookkeeper and less than for some of the skilled workmen of the operation. In other words, the logging engineer, who has spent four years in college, or the equivalent in practical work, is worth no more than a bookkeeper, who

can learn the simple routine of camp accounting in a few days. It may be true that the author found some second-rate men masquerading as logging engineers at this rate, but he evidently failed to ascertain the salaries of the prominent and representative engineers who reviewed his manuscript. It is unfortunate that this statement should appear twice in a publication which will be circulated as widely as this bulletin, since the logging engineer is just beginning to take his place as the man in charge of the planning of operations, and as such is being placed on a par with the foremen or other high-salaried men.

Since the industry is in a state of rapid evolution and the publication of the bulletin was evidently delayed for some time following its compilation, several important changes might be given. High lead logging, which is mentioned as a special method, would now be described as the standard method. As a result, the standard yarding distances listed would have to be considerably decreased, and the Duplex loading method would be described as the standard method of loading logs. If the bulletin were written at the present time, mention would need to be made of the swinging-boom method of loading, and also the two-speed donkey engine, which is meeting with considerable favor.

The description of operations is taken up chiefly from the standpoint of costs rather than from that of comparative efficiency. This is in keeping with the announcement made in the preface, namely, "greatest emphasis is laid on costs, especially costs about which not much written material is available." The lists of costs are very complete, and in many places the fluctuation is given over a period of several years. Unfortunately, all of the costs cover a period prior to April, 1917—that is, previous to the present era of war prices, and are, therefore, entirely out of date.

However, the bulletin is presented in a very readable form and forms a valuable addition to the publications on lumbering.

E. T. C.

Wood and Other Structural Organic Materials.[1] By Charles H. Snow. 1917. Pp. 478. McGraw-Hill Book Co.

It will be of value to many foresters and teachers to know that a concise summary of the influence of wood-destroying animals and the approved remedies and preventatives devised have been prepared by one who has devoted special study to this field. Snow is an engineer who has given special attention to shipworms and to methods of controlling

[1] See also review in Vol. XVI, p. 585.

them. The common injurious animals with which the engineer deals are shipworms, the crustaceans, *Limnoria, Chelura, Sphæroma,* barnacles, and the molluskan pholads. Snow devotes a chapter (pp. 300-325) to summarizing the injuries to wood which are made by animals. Numerous methods have been tried to secure protection from marine borers, such as transference to salt water, by external protective coatings for the wood, of metal, tiling, cement, large-headed nails, or a paraffine mixture reinforced by burlap. By impregnating wood with creosote, protection is given as long as the creosote lasts, even as much as forty years. Of terrestrial wood-destroyers, attention is called to the fact that engineers seldom protect wood from the attacks of beetles, although living trees are often destroyed by them. From an engineering standpoint, termites, or white ants, are the most destructive of land wood-destroying animals.

C. C. A.

Eighth Annual Report of the Conservation Commission, State of New York, 1918. Albany, 1919, 205 pp.

The Eighth Annual Report of the New York State Conservation Commission is a reply to the challenge of its opponents and critics. Coming at a time when the commission is under fire, it sets forth clearly just what the commission has accomplished and what it proposes to do. By reading this report, any citizen of the State may inform himself as to the work of this State department and draw his own conclusions.

This report, more than any in recent years, is a finished piece of literary work, for which credit is due the unflagging zeal of the commission's able secretary, Warwick Carpenter.

The report consists of 205 pages, divided as follows:

	Pages
General Topics	32
Fish and Game	62
Land and Forests	43
Waters (Storage and Power)	28
Saratoga Springs	19
Miscellaneous	21

It is superbly illustrated by 24 plates.

Space does not permit the briefing of any but the section on Land and Forests, which is, of course, of the greatest interest to foresters.

As the report points out, the administration of the forest preserve—an area about one and a half times the size of the State of Delaware, intermixed with private land of even greater area and bounded by more

than 9,000 miles of lines—is not an easy problem. It is, therefore, greatly to the credit of the commission that trespasses such as were committed a decade ago are unknown.

In past years the commission has urged legislation which would give it authority to regulate lumbering operations on privately owned lands, with a view to stimulating tree growth and perpetuating the forests. The legislature has not favored this, but has, through the appropriation of funds to acquire land, made it possible to accomplish the same objects in another way.

The purchase of 159,855 acres, at an average price of $5.83 per acre, has been approved, and 18,635 acres more expropriated. This, added to the present area of 1,838,322 acres, gives a total of nearly 2,000,000 acres in the forest preserve.

A new high record was made in planting 4,213 acres. Some of this work was done by women who worked in the planting gangs. The women gave complete satisfaction. In addition to the 4,213,000 trees planted on State land, 426,000 trees were given to State institutions and 2,597,785 trees were sold, making a total of 7,236,785 trees, or, perhaps, 7,000 acres planted altogether. The production of the State nurseries in the year was 7,236,413 trees. This it is planned to increase largely.

The commission feels that it is now safe to resume the planting of white pine under the following conditions:

1. That the stock which is to be planted shall be absolutely free from any disease.

2. That the plantation be made on an area on which there are no currant or gooseberry bushes.

3. That there be an immune zone of 500 yards around the plantation which is free of Ribes.

The work of eradicating Ribes on 29,337 acres cost as high as $2.35 per acre and as low as $0.31 per acre, an average of $1.46 per acre—an excellent showing.

In 1918, which was a dry year, 398 fires burned over 7,354 acres and did damage to the extent of $8,170. Ten years ago 368,072 acres were burned, with a loss of $802,135, which shows the improvement made.

Among the causes of fire, railroads lead (25 per cent of number, 10 per cent of area), with smokers a close second. Fishermen, burning brush, and campers follow in the order named, then berry-pickers, lightning (19), incendiary, and hunters. The rest are less than ten each.

Statistics of forest products for the cut in the State show a further falling off. The total for 1917 was 861,870,781 board feet, of which

360,541,000 board feet were lumber and an equal amount of pulpwood. New York dropped below the billion-feet mark ten years ago and shows no sign of recovering its former position.

Under the heading of war work, mention is made of the wood-fuel campaign, the timber census, etc. Among the forestry lessons taught by the war are cited the need of protecting watersheds by reforestation, for the purpose of greater power; that timber-growing must be encouraged by proper taxation, in order that it may be profitable for land-owners to use suitable land for the production of a forest crop; that wood must be used more freely as fuel, and that forests must be protected more effectively than ever before.

To all of which the reader will say, "Amen—so be it." But he will look in vain for any mention of another lesson taught by the war, equally obvious and of capital importance, namely, that the State forest preserve should be made an asset rather than an expensive luxury. The Conservation Commission in 1918 spent $875,702.68; it took in $349,621.75. Here is a deficit of half a million dollars, most or all of which can be saved the taxpayers by the judicious sale of matured timber.

A. B. R.

PERIODICAL LITERATURE

BOTANY AND ZOÖLOGY

American Oaks

Trelease has recently published two important papers on American oaks; one on the ancient oaks of America and the other on the naming of American hybrid oaks. The purpose in the first of these papers is to bring together the scattered facts relating to fossil American oaks.

The many species of oak which are now a most striking component of forest vegetation in America and of large economic value are worthy of much attention on the part of silviculturists and dendrologists. A thorough knowledge of living species demands some knowledge of those that existed before our own day. Although a large number of fossil oaks have been described, they have, for the most part, been identified from the impressions of leaf fragments. Only two fossil species appear to be known in fruit. Due to the fragmentary character of fossil material and the absence of twigs and fruits, many fossils appear to have been called oaks rather because they could be called nothing else than for any other positive reason.

Early identifications often placed European and American forms together, but at present very few American fossil oaks are considered identical with European species. The earliest appearance of *Quercus* is in the Cretaceous, for which 48 species are recognized in the United States and Canada. None of these survive the Cretaceous and none closely resembles existing oaks. Fifty-six species are reported from the Eocene, distributed from Alaska to Mexico. Like those from the Cretaceous, none closely resembles living species. The species for the Miocene, numbering 42, are widely distributed over the United States. These oaks are more closely related to existing species, as shown in the fact that a Miocene oak of California has been considered a variety of an existing species. Otherwise none of the species of Miocene oaks are thought to exist today. The Pleistocene oaks, which occur in glacial and later deposits, are strikingly like existing species and many are considered identical, while others are believed to be ancestral forms of present species.

The author has arranged the principal leaf types of American fossil

oaks in a key, but without regard to horizon. This arrangement is for convenience of reference rather than the showing of relationships. The text is illustrated with nine plates showing different leaf types.

The second paper by Dr. Trelease deals entirely with American hybrid oaks. The reviewer is impressed by the large number of reported hybrids. In no case, however, has hybridization been definitely established between the black oaks and the white oaks. The author states that in his study of American oaks he has had to account for a considerable number of hybrids, some of which have been described and figured as species in the ordinary sense of the term, while others have been made known by reference to specimens more or less generally disturbed by their collectors. He states that no collective treatment of these forms has been made. They are encountered in herbaria sometimes under binomials of their own and sometimes under one or the other of the parental species.

Two methods of designating hybrids are sanctioned by usage. These methods are illustrated in the naming of the hybrid between *Quercus alba* and *Quercus prinus*—a common hybrid of eastern United States.

Quercus alba × prinus.[1]

× Quercus Saulii.[2]

In the former method the names of the two parent species are made use of; in the latter the hybrid is designated by an entirely new binomial.

Each of the indigenous hybrid oaks in the table compiled by the author is designated by a binomial and by the equivalent name derived from the two parent species. More than 125 indigenous hybrid oaks are listed. The paper is accompanied by three plates, showing photographic reproductions of herbarium material.

J. W. T.

Leaf Structure as Related to Environment

This paper, by Herbert C. Hanson, gives the results of a year's investigation, beginning the summer of 1915, the purpose of which was to determine the exact differences in the structure of the leaves in the center of the tree from those on the south periphery—that is, shade leaves and sun leaves. The work is distinguished from most of the previous investigations by the

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[1] *The ancient oaks of America.* Memoirs Brooklyn Botanic Garden, Vol. I, June, 1918, pp. 492-501.

[2] *Naming American hybrid oaks.* Proceedings of the American Philosophical Society, Vol. LVI, 1917, pp. 43-52.

measurement of the environmental factors, and thus deals with the modern phase. The factors measured were: light, evaporating power of the air, temperature, humidity, and wind.

A brief survey is given of the recent previous investigations, in which the work of some thirty investigators is analyzed and the result stated.

The readings for the data on factors were made in the sun among the leaves of the south periphery of isolated trees and at the apex of trees growing in the forest. At a corresponding height to sun readings on isolated trees, readings were taken in representative positions in the crowns; and for forest trees, readings were taken among the lowest leaves. Care was taken to measure the different factors at the same point in the tree. Cytological material was collected from both sun leaves and shade leaves which showed the differences in structure. The response of the leaves under these two different conditions was shown in: the green and dry weights and water content of given leaf areas; the thickness of the leaf and its parts; the compactness of the tissues; the structure of individual cells; and in the macroscopic characters, as area and lobing.

In obtaining the physical factors, light was measured by the Clements photometer between 11 a. m. and 2 p. m. in August. Livingston's standardized porous cups were used for measuring the evaporating power of the air during the period from 8 a. m. to 5 p. m. Temperature was taken by simultaneous readings in the two positions, and was usually 1° C. higher where the light was stronger. Wind velocity was also obtained by simultaneous readings and by means of hand anemometers. Humidity readings were obtained by means of cog psychrometers from the same trees from which the temperature data were secured.

Much original data are given on the effects of the physical factors under the two contrasted conditions, set forth in tables and illustrated by drawings of leaf sections.

The article on the whole impresses one as the result of careful and well planned work according to the best modern methods, and that it has yielded results of value. The previous work is apparently well canvassed and full use made of the data obtained and theories advanced by other investigators. The results obtained are also thoroughly discussed and compared. A bibliography is appended and the essential points summarized by the author as follows:

1. The light intensity, as measured by the Clements photometer, within the crown of 10 common broad-leaved trees was found in August to vary from .0076 of full sunlight in *Acer saccharum* to .1132 in *Quercus macrocarpa*.

2. The evaporation, measured by the Livingston porous cup atmometers, was found to be from 1½ to 2⅓ times as great at the south periphery as within the crown.

3. The temperature at the south periphery was usually but one or two degrees higher than within the crown.

4. The humidity, measured by cog-psychrometers, was usually from 1 per cent to 6 per cent higher within the crown.

5. A wind of low velocity caused greater differences in the air movement between the center and the periphery of the crown than a strong wind. The wind was found to be from 1⅓ to 8 times as strong at the periphery as within the crown.

6. Transpiration experiments showed that the south periphery leaves lose more water per unit area than the center leaves. In *Fraxinus pennsylvanica,* the south periphery leaves lost from 3 to 6 times as much as the center leaves; in *Ulmus americana,* about 12 times as much. Even when the potometer containing south periphery leaves is placed under similar conditions with the potometer containing center leaves, it will lose more water per unit area.

7. The leaves from the periphery of the tree were usually more deeply lobed, more prominently toothed, and smaller than the leaves from the center of the same tree.

8. The water content of the leaves from the center of the tree was always higher than that of the leaves from the south periphery. The amount of dry material per unit area in the exposed leaves bears a relation to tolerance. The dry weight of the leaves of the most tolerant trees is less per unit area than the dry weight of the leaves of the least tolerant trees, as leaves from *Acer saccharum* contain 1.029 grain of dry matter per unit area, while leaves from *Quercus macrocarpa* contain 1.272 grains.

9. *The differences in the total thickness between the south periphery and the center leaves on the same tree are usually greater than the differences heretofore reported from leaves of mesophytic and xerophytic forms of the same species.* The leaves from the south periphery have more palisade tissue, greater compactness of structure, thicker epidermis and cuticle than the leaves from within the crown.

E. R. H.

American Journal of Botany, November, 1917, Vol. 4, pp. 533-560.

SILVICULTURE, PROTECTION, AND EXTENSION

Mesopotamia and Afforestation

Nicholson writes regarding the advisability and practicality of afforestation on a large scale in Mesopotamia.

Lower Mesopotamia, bounded on the east and north by hills and on the west by deserts, is a vast plain, for the most part clay or sandy soils of great depth and potential fertility—a tract of country which in the period before the Mongolian invasion and Arab apathy yielded plenteous harvests of grain and which can by extensive irrigation again become one of the world's grain fields. This section of the country could not, then, be considered in any large afforestation scheme; but since there is at present here a dearth of timber of any kind, it is considered advisable that afforestation be undertaken on waste areas to the extent of furnishing the district with its requirements of small timber for fuelwood, etc.

Neither the Syrian desert nor the sandy gravelly tract adjacent to these plains of Lower Mesopotamia lend themselves to afforestation unless afforestation is linked up with irrigation systems. To the east and north are hills interspersed with plains, the soil varying from pure gravel to sandy clay or rich loam. The absence of hard rock brings about erosion and the configuration of the ground remains indeterminate, only the higher ridges having attained any definite form. Here the land, except for the scattered plains, is of forest or pasture soil, is independent of irrigation, owing to greater rainfall, better soil aëration, and the presence of springs and streams. Moreover, this region is not altogether destitute of timber. This, then, would seem to be a promising section of the country for afforestation. The prosperity which the grain fields of Mesopotamia will bring to the country and the remoteness of foreign supplies of timber would seem to justify afforestation of this section, which at best yields poor pasture. The protective rôle the forests would play in the conservation of moisture and the prevention of floods is an added reason for afforestation.

As to the practicality of afforestation, though records are not available, it is considered that climatic conditions would be favorable and that the rainfall would be sufficient to support forest growth, the explanation of the absence of forests in this age being their gradual destruction by men and animals, rendering natural reproduction impossible. If, however, this impossibility results from desiccation of the soil rather than from the effects of grazing, "the outlook, from the forester's point of view, is not very hopeful." Hope of success may be

gleaned from legends of the country, which tell of "hills covered with stretches of boundless forests."

The conclusions reached by the author are: Afforestation is practicable, but not everywhere; that, considering the difficulties to be overcome, afforestation should be experimental in character and limited in extent; the fertile tracts in the hills and portions of the broken plains not given over to agriculture should be the field for experiment.

Indian Forester, October, 1918, pp. 476-485.

MENSURATION, FINANCE, AND MANAGEMENT

Is Forest Planting Profitable?

An interesting financial transaction is reported in detail by Luttrell concerning a plantation made in 1881 with 137 Douglas fir in 10-foot spacing. The harvest in 1918 yielded 2,459 cubic feet of round timber and pitwood, sold at $1,336. Expenses of lumbering were $218, leaving net receipts of $1,117, or approximately at the rate of $2,259 per acre.

There are Douglas fir upward of 40 feet high growing outside the plot and self-sown from it.

The plot was replanted in 1918 by National Service women with Japanese larch, which have made a good start.

Quarterly Journal of Forestry, January, 1919, pp. 58-59.

UTILIZATION, MARKET, AND TECHNOLOGY

Treatment of Timber

A review is here given of the results obtained by the forest department after years of experimental work in the treatment of Indian timbers for sleepers and published by Mr. Pearson in "Antiseptic Treatment of Timber Recording Results from Past Experiments." This work is said to be very replete in information. There are 32 species included. All of the standard and well-known treatments were used. Mr. Pearson states that "it is difficult to lay sufficient stress on the importance of seasoning timber before treatment, for unless proper care is taken in this respect any undertaking of this nature will be doomed to failure." In dry, hot localities the moisture content should not exceed 15 per cent and in humid localities 25 per cent. Steaming at 250°, in cylinders, followed by vacuum and also boiling in oil at 230° F. is used. Pressure plant

gives better results than open-tank treatment. A long list of antiseptics was used, including oils, tars, and salts. The latter are liable to leach out during the rainy season. "Cheap creosote of good quality is at the basis of the whole question, and so long as India has to import all its wants, so long will the treatment of sleepers be handicapped."

Duration tests have been conducted in six groups of antiseptics, and the average life of untreated and treated sleepers is stated. "Reviewing the results of all six groups of laboratory experiments, it may be stated, generally, that the hard and moderately hard woods treated, as compared with untreated specimens, have fared, in proportion, better than the softwoods. The results obtained with Powellized timber are fairly satisfactory, but the outstanding feature of the experiments is the superior results obtained with the various coal-tar creosote products as compared with salt solutions."

H. D. T.

Indian Forester, September, 1918, pp. 424-434.

EDITORIAL COMMENT

Is Public Purchase of Private Timber Lands the Only Solution?

The annual meeting of the Society of American Foresters, held in Baltimore December 27 and 28 (1918), adopted a number of resolutions as the attitude of the profession toward important forest problems of the day. These resolutions are printed elsewhere in this issue of the Journal.

One has especial bearing on the future national forest policy of the United States. It reads as follows:

Whereas a sustained timber supply adequate in quantity and diversified in quality is alike essential to national defense in war time and national progress in time of peace; and

Whereas the growing of timber to the larger sizes involves an investment too long in time, with too great hazards and too low a rate of final return for private capital to undertake; and

Whereas only 30 per cent of the present forest area and but little more than 20 per cent of the existing timber stand is in public forests in the United States—a wholly insufficient basis for the future timber supply of the country—therefore be it

Resolved, That the Society of American Foresters urge the immediate initiation of a permanent policy of national and State, or other public acquisition of forest land, until the acreage of publicly owned land capable of producing timber is sufficient eventually to supply the bulk of the raw material required by the nation.

It is very much to be regretted that such an important resolution, committing the Society of American Foresters to a definite national forest policy, was adopted without any opportunity for deliberation by the entire membership of the Society. Its wording conveyed the impression that the Society believed the only solution of the forest problem in this country to lie in the acquisition of forest lands by the public. It has already been interpreted by lumber journals as a frank admission on the part of foresters that private timber owners cannot profitably engage in timber production, and therefore are given a clean bill of health for all the devastation and destruction they may work on the national timber resources in their custody.

We are far from denying the great importance of public ownership of forest lands for providing the future needs for timber in this country. No one has been more ardent in advocating the need for extend-

ing ownership of forest lands of this country by the public than the editors of this JOURNAL. We still believe that the enactment of the Weeks law, authorizing purchase of private timber lands by the Government, was one of the wisest and most far-reaching legislative measures adopted within the last decade. We are advocating with all our strength, and with deepest convictions of the wisdom of the action, its extension so as to cover not only forest lands needed for watershed protection, but also forest lands for timber production alone. What we should like to guard against is the practical limitation of such a policy, and therefore its inadequacy for the immediate solution of the serious situation with respect to future supplies of timber. It is only because we believe that as an immediate solution it is not likely to accomplish any tangible results within the brief space of time which we have left in which to make our remaining timber last, that we cannot see in this policy alone a practical solution.

The sponsors of the resolution have evidently entirely overlooked the fact that in order for public ownership of forest lands to accomplish the purpose which they had in mind the people of this country, either the Federal Government or the States, must acquire within a short space of time the greater part, if not all, of the 78 per cent of the country's forests, including the best and most accessible timber now in private ownership.

These private timber lands represent a value close to six billion dollars, not including the mill and logging equipment, in which another billion dollars is invested. While the war has demonstrated that nothing is too great for the Government to undertake when the necessity is evident, especially since under conservative management this investment could pay a fair rate of return on its entire valuation, it is difficult to conceive that the present or any other Congress confronted with a budget two or three times larger than before the war would ever give its consent to the Government undertaking such a policy on a large scale. Yet nothing short of large-scale public timber-land purchase can solve the problem. As a matter of fact, it is doubtful whether even the advocates of this resolution intended that the Government should undertake purchase of public lands on such an enormous scale. What they evidently had in mind is the gradual acquisition of private forest lands as they are cut over by their present owners. It is roughly estimated that from 10 to 12 million acres of private timber land is cut over every year. Of this about one million acres is cleared for agricultural use, six to seven million acres comes up mostly to inferior second growth, and from three to four million acres becomes waste

land. Even under the most careful management, approaching the present European practice, it may be conservatively estimated that from 350 to 400 million acres of productive forest land is needed to meet the timber requirements of this country in perpetuity. Leaving out of consideration doubts as to the wisdom of buying only waste lands, if the Federal Government and the States should acquire each year merely the three to four million acres of most severely cut-over land, even allowing for the more than 100 million acres already in Government ownership, it would still take in the neighborhood of 80 years for the country to become assured of sufficient forest area to produce the timber it needs. This solution, therefore, will come too late to save our remaining timber resources. To do even this, the Federal Government and the States will have to have regular annual appropriations, aggregating at least 10 to 12 million dollars for the purchase of waste land. This does not include any appropriations necessary for the protection or reclamation of these lands, but of course such provision will be necessary, since the desired objects would not be attained by the purchase of lands without making them productive.

In the light of our past experience in the purchase of timber lands, we seriously doubt whether such appropriations would be forthcoming. It took twelve years of agitation and education of the public before Congress passed the Weeks law and appropriated $11,000,000 for the purchase of private timber lands essential for protection of critical watersheds of the country. During the eight years of the operation of this law less than 2,000,000 acres have been acquired or approved for acquisition by the Federal Government and practically none by the States. During these 20 years at least 60 million acres of privately owned timber lands became waste land. What assurance, then, have we that in the future purchase will keep pace with devastation? Meanwhile the destruction of our remaining timber resources is going on at an accelerated rate. The timber holders of the southern pineries, fearing competition of Douglas fir, made more real since the construction of the Panama Canal, are bending all their efforts to "retire their investment" in timber by excessive cutting. J. E. Rhodes, Secretary of the Southern Pine Manufacturers' Association, recently made the public statement that within five to eight years over 3,000 sawmills in the South will cut out their available timber. According to other lumbermen, the entire stand of virgin southern yellow pine will be cut out within ten years. Whether this is true or not is not pertinent to our discussion, but is significant of what is taking place in the lumber industry.

Another elementary point which foresters, most of all, should not forget is that unless cut-over land comes up naturally to forest within a few years, or is prepared for agriculture or pasture, its reclamation for forest purposes becomes a very difficult and expensive task. On the other hand, when the practice of forestry begins with the forest still on the ground, its perpetuation is in many cases a simple matter, often merely at the cost of fire protection. If, therefore, we adopt a *laissez-faire* policy toward private timber holdings, and the public assumes control of them only after they have been laid waste, their reclamation will strain the financial resources of the States or even of the Federal Government. England's example ought to be very instructive. The plans of the United Kingdom for the next ten years provide for an appropriation of over $17,000,000 to reforest about 200,000 acres, and yet England, with its island climate, offers most favorable conditions for tree growth.

It is commonly believed that the older countries of Europe have solved the problem of continuous forest production by government ownership of timber lands. This does not entirely square with the facts. In Switzerland, for instance, where forest management is highly developed, the government owns only 4.6 per cent of the forest area; in Belgium, 4.8 per cent is owned by the State; in France 12 per cent; in Austria 10.7 per cent. Even in Germany, where State ownership was more highly developed than in most other European countries, less than one-third was in actual government ownership. Yet most of the forests of those countries are on a continuous productive basis. While in our own country, with 22 per cent of the area under Government and State ownership, the timber supplies are rapidly disappearing.

It is further to be regretted that the resolution takes it for granted that the practice of forestry by private timber owners is unprofitable, and they should therefore not be held morally responsible for the proper use of their forests. While it is true that except under special conditions forestry is profitable only in the long run and financially means "present expenditure or foregoing present revenue for the sake of a future revenue," there is or ought to be enough profit in the exploitation of the virgin timber, properly carried on, to leave the ground not a waste, and here the aid of the Government may well come in, as indicated below. Under certain conditions real forestry practice in virgin forest may even be shown profitable from the start if no speculative profits were looked for.

The farmers of this country engaged in production of food so essential to the nation earn on the average less than 3 per cent on a simple

interest basis, yet no one would for that reason undertake to justify the taking over by the Government of the production of food or to excuse the farmer for allowing his land to deteriorate so far as to endanger the public interest. In public discussions of the possibility of the practice of forestry by private timber owners, it must be clearly recognized that if the large timber owners in their operations regard the forest merely as a mine, it is not often because they cannot handle it as a continuous resource with a fair profit, but because, being accustomed to speculative profits, they are unwilling to engage in continuous forest production which promises only a moderate return.

Whether the policy of public ownership is adopted or not, the country cannot afford to allow its remaining forest lands to be devastated. Forest devastation must stop. Acquisition of as much land as possible by public agencies is a move in the right direction, but does not afford immediate relief. It must be brought about by placing the bulk of the non-agricultural private forest land on a permanent forest-production basis. The States and the Federal Government, in cases where lumber enters into interstate commerce, have the constitutional right and the moral obligation to prevent laying waste of forest land.

Timber owners should be required upon removing the timber to either reforest their land, leave it in such a condition that it will restock naturally, or prepare it for agriculture or for pasture. In case of failure to do either of these things, the land should revert to the State, which should take steps to put it to its highest economic use. The assessment of waste land for taxation purposes at the value which it would have if put to its best use might also be effective in causing cut-over land to be left in a productive condition. Fire protection, particularly of second-growth forests, should be insisted upon.

Private owners may be encouraged and helped to practice forestry by proper forest taxation laws, by State insurance against loss by fire or otherwise, by providing cheap credit through State or Federal forest loan organizations similar in principle to the Federal Farm Loan Banks, by co-operation between public and private owners in managing their forests and in marketing their products, pooling resources if necessary, and by other measures of similar character.

The acquisition of the bulk of the forest lands by the public, though desirable as the ultimate solution of the problem, is not sufficient, as far as the immediate future is concerned. It will be necessary to place these lands on a continuous forest-production basis while they are still in private hands if our remaining forests are to be saved and our wood-using industries are to prosper.

The editors are unwilling to consider the resolution as it passed the last meeting of the Society as the mature and best judgment of its membership. We should like, therefore, to throw open the pages of the JOURNAL to a full and frank discussion of the problem, "What is to be done with private forests?" The contribution of H. S. Graves, which appears in this number, opens a discussion which we hope will be followed up in succeeding numbers.

IMPRESSIONS OF THE BALTIMORE MEETINGS

The American Association for the Advancement of Science meetings in Baltimore, December 26 to 28, 1918, were very successful and the character of the papers presented and the discussions were on a high plane; in fact, higher than those heard at the Pittsburgh session in 1917. In all the meetings of the affiliated societies in the Botanical Section, at least, the programs were well arranged and the papers dovetailed into one another remarkably well. This feature contributed very largely to the interest in the sessions and also to the discussion, provoking the highest kind of criticism and comment and giving every one a wonderful stimulus toward better, more thorough, and more conscientious work.

Two things which were emphasized and reiterated were the recognition during the war period of the value of research by outside interests, who had previously not thought it of practical value, and the need for more careful, better, and systematic research in all things botanical. Pure research, as contrasted with so-called applied research, has at last been recognized by organizations which prior to the war had not seen any advantage gained from exploring the realms of the unknown in search of primal causes.

In forestry the need of research was brought out time and time again, as papers presented the discovery of certain fundamental principles which will have a great bearing on future forest policy and on silvicultural practices. Studies of the distribution, growth, and silvics of forests emphasized how little is really known as yet of the underlying causes, and was evidenced by the differences in opinion during the discussions. The progress of research at the Forest Products Laboratory during the war was strongly brought out, and the great advances in technology and the use of woods contrasted strongly with how little has been done in forest production. That this is realized by foresters, and steps are being taken to overcome it, is evidenced by the establishment of an experiment station in connection with the work of

the State forest school of Pennsylvania, at Mont Alto, and by the establishment of a similar station in Ontario through the co-operation of the State and large pulp and paper interests.

The need of co-operation and co-ordination of work in solving problems was developed in the papers of Coulter, Whetzel, and Duggan in a symposium on the botanical opportunity, and in papers of Livingston, Harper, Moore, and Lyman dealing with botanical research and the war. It was shown that in certain studies where the botanists had pooled their ideas and talents solutions were arrived at with the minimum loss of time and effort. As the value of such work has now been demonstrated conclusively, it is improbable that science will again depend wholly upon individual effort for the solution of its problems. The failure to secure a number of angles on the situation by men working on the same subject, and to confer with those working in other fields on similar lines, stood out as one of the weak points of the forest investigative work so far. The co-operation of foresters with soil experts, chemists, and botanists on a single subject has so far, at least, been a rarity; but it has now been shown more clearly than ever before how great is the need for such co-operation.

The work of the National Research Council and its plans for surveying the scientific field in its entirety was vividly portrayed by Dr. George E. Hale. The known work done throughout the world is to be compiled and kept up to date by the International Council, so that an investigator in any field may be able to have at his elbow, so to speak, a résumé of all that has been done or is known regarding the problem that confronts him, which will prevent the great duplication and multiplication of effort that has marked research work in the past.

Among the forestry papers that caused considerable thoughtful discussion were those by Kirkland and Recknagel in the realm of economics and those by Illick, Pearson, Leavitt, and Toumey on silvical work. All the papers showed careful and thoughtful preparation and the search that is being made in silvics for the fundamentals governing growth and distribution of species. Before the Ecological Society papers by D. T. McDougal on the measurement of tree growth and B. E. Livingston on climatic temperature complexes were of great interest to those foresters who were able to hear them, as well as Whitford's papers on distribution in Brazil and in British Columbia. Unfortunately, the program was so arranged that it was necessary to miss many interesting subjects in allied lines before other societies, but this was unavoidable in general meetings of this character. However, much of this could have been avoided if the meetings had been called on time

and if one or two individuals with important papers had seen fit to be present at the time agreed upon.

General papers by Bryant and Clapp on general research work carried on during the war were generally instructive, as was the rather informal talk of Hirst on the work of the New England forestry units. Similarly, the informal and impromptu talks at the smoker and dinner were decidedly illuminating and interesting. Major Moore told of work and experiences in France, and Elwood Wilson and Leavitt told of Canadian developments and plans, that of using hydroplanes in locating forest fires being of more than ordinary interest. A general discussion, led by Kellogg and Peters, on State forestry and policies, showed how tangled this work could become.

In general, the conferences, conversations, and discussions did much to promote and advance new ideas, which will be carried into far fields, and personal contact and acquaintance with other workers developed, known previously only through correspondence and cold type. Altogether, the sociability and general informality which marked the meetings of the Society were features that created what is believed will be a lasting impression, and many differences of opinion on phases of the profession were ironed out and toned down, so that in the future greater good and better understanding will develop.

EDW. N. MUNNS.

A Turning Point in New York

Elsewhere in this issue is printed the resolution adopted by the New York State Forestry Association at its recent meeting in Albany, wherein that association goes on record as favoring a broad policy for the economic use of forest land in the State—a policy looking forward to the removal of the constitutional inhibition which at present prevents effective use of the State Forest Preserve. The adoption of this resolution may be a turning point in the development of forestry in New York State. It was adopted only after a heated discussion, in which the issue was squarely drawn between the æsthetic interests and those who favor a wise, economic use of the State Forest Preserve.

This matter is familiar to our readers, since the struggle has been going on for many years. The New York State Forestry Association attempted to straddle the fence and to combine in its membership the divergent interests. This policy led to an intolerable situation, which came to a head in the January meeting. The association has dwindled in influence until the taunt was openly made that it was half dead or

dying. As one of the speakers stated: "This situation is due directly to the failure of the association to take a definite stand on the issue of how best to use the State forests."

To one not familiar with the situation in New York State, it seems well-nigh incredible that the State should maintain two institutions wherein forestry is taught and foresters are trained and yet on its own land fail to practice what it preaches.

The challenge to the forestry profession is a direct one, since it is the avowed policy of the æsthetic interests to prevent any cutting in the Adirondacks and to keep them permanently as a pleasure park only. Foresters throughout the country are concerned in this issue, which assails the correctness of their tenet, that the forest can be made to produce useful material and still be just as attractive to campers, hunters, and health-seekers.

The resolution provides for the appointment of a committee to formulate a constructive policy. This committee will comprise representatives from the Conservation Commission, the New York State College of Forestry, Cornell University, the New York State Forestry Association, the Association for the Protection of the Adirondacks, and the Empire State Forest Products Association. These representatives may be expected to line up somewhat as follows:

The Conservation Commission, in its recently issued report for 1918, thus declares its attitude:

> "The commission, in the performance of its duty to enforce the provisions of the Constitution respecting the Forest Preserve and acting under the advice of the Attorney General, has taken the position that no one shall have the exclusive use of any portion of the preserve; that no one shall be allowed to claim any particular camp site from year to year; that the forest lands and waters shall be enjoyed by all the people as far as is possible and compatible with the public policy expressed in the Constitution."

In former reports the commission was not so neutral in its attitude. Thus in its fourth annual report, speaking of the State forest preserve, the following declaration occurred:

> "The proper use of this great area is a matter of vital importance. The constitutional inhibition practically prevents any direct use, except for camping, hunting and fishing. The entire wood production on the mature areas is at present a total loss, because there is no utilization of the larger trees. If we assume that the average annual growth should be 200 feet per acre per annum, then the annual growth on the merchantable forest areas alone would approximate 240,000,000 feet, board measure. Once the land is placed under systematic forest management, this amount could be secured annually without reducing the forest itself. It means taking the interests on the wood principal. The quantity would be

further increased by ultimate growth on what are now non-merchantable areas and through reforesting of denuded lands."

Quoting further from the same report:

"The present system does not best provide a future supply of timber . . . The question of the source of supply of our necessary wood material is one that must be seriously considered . . . if the resources of the State are properly developed the necessary supply can be produced.

"Good forest management which will produce better commercial forests is none the less useful in producing the indirect benefits."

The representatives of the educational institutions at Syracuse and Cornell will, of course, favor a proper use of the forest preserve.

The State Forestry Association avowedly favors "a rational policy in managing the forest lands owned by the State," and its representative may be counted on to uphold this viewpoint.

The Association for the Protection of the Adirondacks has since its organization, in 1901, been a controlling influence in respect to the handling of the forest preserve. It regards itself as the "watch-dog" of the Adirondacks, and the representative of this association is likely to brand any measure proposed as a dangerous and unnecessary impairment of the constitutional protection of the forest preserve.

Finally, the Empire State Forest Products Association, while not free from the taint of commercialism, has in recent years contended for a broad, public-spirited, comprehensive policy, which will establish a rational and practical treatment of the great conservation questions, whether they be forest or water-power. In this respect its representative will take his stand with the forces of education and progress.

Thus, when the committee assembles, four out of the six representatives may be counted on to favor a forward-looking policy. If their viewpoint prevails and is accepted by the people of the State, it may be that the long night of disuse is over and that the morning of a better day for foresters in New York State is at hand. It will require the passage of a resolution by two successive legislatures and a referendum by the people and it cannot become effective until January, 1922. To accomplish this, a campaign of education and enlightenment is needed, overcoming old prejudices and inculcating the proper viewpoint in regard to matters of forest policy.

Meanwhile it behooves every forester, whether he resides in New York State or not, to get behind this movement and to "give a reason for the faith that is in him."

A. B. R.

NOTES

Meeting of the Association of Eastern Foresters

In accordance with the earlier notice, the winter meeting of the association was held at Janssen's (formerly the Hofbrau), Broadway and 30th streets, New York City, on February 1, 1919. The following program was carried out:

The Need for and Suggestions Concerning a Permanent Forest Research Program	J. W. Toumey
The Possibilities of Interstate Co-operation in Public and Educational Forest Administration	G. H. Wirt
The Relation of Timberland Ownership to Forestry	W. O. Filley
Forestry and the New Economic Conditions	R. C. Bryant
Does Forestry Need a Different Advertising Viewpoint?	T. C. Hirst
The Recent Fuelwood Campaign a Stimulus for Permanent Utilization	W. D. Clark

A committee of three was appointed by the chairman to formulate and put into effect a forestry research program for the Eastern Foresters Association, and that they be requested to confer with the Society of American Foresters for the purpose of fitting in with a national program. Committee appointed: Mr. Toumey, chairman; Mr. Illick, Mr. Hirst.

C. P. Wilber, *Secretary.*

Results of an Experimental Eucalyptus Plantation in Hawaii

There was established in 1911 in Nuuanu Valley, Honolulu Watershed Forest Reserve, Oahu, Territory of Hawaii, by the Division of Forestry, in co-operation with the United States Forest Service, a plantation of 18 different species of eucalyptus. The object of this plantation was to secure data as to the habit, form, rate of growth, and relative value under local conditions of species of eucalyptus supposed to be of economic importance, but little known in Hawaii. On account of exposure to strong trade winds sweeping down the valley and the rather excessive rainfall, averaging about 175 inches annually, and the presence of a rank growth of grass, the conditions for the best growth and development were not favorable, and the trees in this experiment may be said to have undergone a very severe test. At the end of five

years a count of the trees was made and their height and diameters measured. Success varied from 39 to 93 per cent; maximum height reached was 38 feet in the case of yellow stringy bark (*E. muelleriana*) and mountain ash (*E. sieberiana*). The maximum d. b. h. reached in this period was 8 inches for tallowwood (*E. microcorys*). On some of the plots the trees were mere spindling whips, hardly erect, and often sprawling over the tall grass. In others, where protection was afforded by small gulches, the growth was excellent.

Eight of the species tried gave a yield of one cord or over per year, the highest being given by the blackbutt (*E. pilularis*)—4.51 cords per acre. None of these are exceptional and do not compare with the yield of bluegum (*E. globulus*) at Makawao, Maui, Territory of Hawaii, which at the age of five years ran as high as 15.1 to 17.4 cords per acre.

Mr. Judd remarks, however, that for results to be expected from the planting of trees of the species tried under conditions similar to this plantation the data given may be used as criteria. As results of this experiment the following species appear to be most likely for planting under the conditions stated: Blackbutt (*E. pilularis*), tuart (*E. gomphocephala*), yellow stringybark (*E. muelleriana*), mountain ash (*E. sieberiana*), tallowwood (*E. microcorys*), red gum (*E. rostrata*), sugar gum (*E. corynocalyx*), and gray gum (*E. tereticornia*).

New York State Forestry Association

The following important resolutions were adopted at the seventh annual meeting of the New York State Forestry Association, in Albany, on January 21, 1919. The committee which reported these resolutions consisted of Dean Hugh P. Baker, of the New York State College of Forestry, Syracuse, N. Y.; Prof. Ralph S. Hosmer, of Cornell University, and A. B. Recknagel, Secretary of the Empire State Forest Products Association:

Whereas as the association believes that the agencies concerned with forestry in this State should formulate a broad policy for the economic use of forest land in the State, and that this policy should look forward to the removal of the constitutional inhibition at present preventing effective use of the State forest land; and

Whereas this period of reconstruction is a particularly opportune time for the formulation of constructive policies for the use of forest land:

Resolved, That the president be authorized to appoint a committee to be composed of one representative from each organization interested in forestry in this State to formulate the indicated policy. It is suggested that the following organ-

izations shall be represented: Conservation Commission; New York State College of Forestry, Cornell University; New York State Forestry Association; Association for the Protection of the Adirondacks, and the Empire State Forest Products Association,

Whereas the question of the development of water-power on both State owned and private land is now before the people of the State; and

Whereas this association is vitally interested in water conservation through both reforestation and building of storage reservoirs: be it

Resolved, That this association commend the policy of water conservation and water-power development as formulated by the State Conservation Commission in its report for 1918; and be it

Resolved further, That more aggressive reforestation by the State go hand in hand with development of storage reservoirs and water-power in the State.

A wood fuel moving-picture film, prepared last summer by the New York State Conservation Commission as a part of the wood-fuel campaign in New York State, is now being shown on the regular circuit of moving-picture theaters throughout New York. The scenario, prepared by Warwick S. Carpenter, secretary of the New York State Conservation Commission, tells the story of the appointment of a county fuel administrator and his work in furthering the use of wood fuel. One of the pictures portrays a meeting in the executive chamber at the Capitol at Albany, where Governor Whitman, the members of the New York State wood fuel advisory committee, and other State officials are seen discussing the proposed program.

Canada Lumber Industry Census

A census of the lumber industry in Canada has just been completed by the Dominion Bureau of Statistics, embracing 2,879 operating concerns, of which 52 were in Alberta, 251 in British Columbia, 29 in Manitoba, 255 in New Brunswick, 462 in Nova Scotia, 603 in Ontario, 60 in Prince Edward Island, 1,151 in Quebec, and 16 in Saskatchewan. The total capital invested in the industry, including land, buildings and plant, machinery and tools, stocks in process and supplies, and working capital, is given at $149,266,019. The number of employees on salaries was 2,874 males and 285 females, who received a total of $3,554,097. The average number of employees on wages was 25,516 engaged in logging operations and 28,820 in the mills, and their combined wages amounted to $34,412,411. The aggregate value of production in 1917 was $115,884,905. The census covered 29 kinds of lumber, 11 of shingles, 10 of lath, 6 of pulpwood, and 10 of miscellaneous products, including cooperage stock, veneer, ties, poles, posts, dressed lumber, etc.

The principal kinds of lumber by species of wood used were spruce, 1,466,558,000 feet; white pine, 791,609,000 feet; Douglas fir, 706,996,-000 feet; hemlock, 322,722,000 feet; cedar, 149,999,000 feet; red pine, 119,321,000 feet; balsam fir, 102,373,000 feet, and all other varieties, including custom-sawed lumber, 483,293,000 feet. The total quantities and values of lumber, lath, shingles, and pulpwood cut, and of miscellaneous products were as follows: Lumber, 4,142,877,000 feet, $83,-655,097; lath, 616,949,000 feet, $1,828,018; shingles, 3,020,956,000 feet, $8,431,215; pulpwood, 988,444 cords, $10,543,630; miscellaneous products valued at $11,436,945.

The Laboratory of Forest Pathology of the Bureau of Plant Industry, U. S. Department of Agriculture, Dr. James R. Weir in charge, has been removed from Missoula, Montana, to Spokane, Washington, where it will be permanently installed in a fire-proof building. The most intensive work of this laboratory is centered in the great white-pine forests of Idaho. To promote pathological investigation in this region, a permanent field station will be established; also a forest pathological museum. All future communications should be addressed to Laboratory of Forest Pathology, Spokane, Washington.

On December 11, 1918, Messrs. Gifford Pinchot, W. T. Creasey, and Fred Benckman, acting as a committee on conservation of the Pennsylvania State Grange, submitted to that organization an exhaustive report on the forestry situation in Pennsylvania. The report is divided into four parts: Dealing with forests; waterways, water uses, and water rights; water-power; recommendations for the continuation of the committee on conservation. Copies may be obtained from Mr. Pinchot, whose address until May 15 is 1218 Real Estate Trust Building, Philadelphia, Pa.

Prof. Alfred Akerman, of Georgia, is at present a member of the instructing staff of the New York State College of Forestry at Syracuse. He expects to return to Georgia next summer, when he will transfer the Georgia College of Forestry from Greene to Towns County, where a tract of land has been acquired.

Lewis A. Zimm has accepted an appointment as extension forester for Georgia with the Extension Division of the Georgia State College

of Agriculture. Mr. Zimm graduated in forestry at Cornell University and later specialized in forest pathology at the same institution, obtaining the degree of Master of Science. During the time at Cornell University he acted as instructor in forestry and plant pathology. Mr. Zimm spent a season in dendropathological field-work, under Dr. Meinicke, on the Pacific coast prior to his being commissioned in the Army.

The Department of Forestry at Cornell University, in the three months' term beginning December 30, 1918, has resumed something like normal activities, with an enrollment of 32 professional students. It is expected that in the term beginning March 31 this number will be considerably augmented by the return of former students who are still in military service.

The committee on the suppression of the pine blister rust in North America has been reorganized under the name of American Plant Pest Committee and will include four officials from each State and province. The purpose is to call public attention to new and dangerous pests and to secure national and State appropriations.

Prof. A. B. Recknagel has been granted a further leave of absence from Cornell University from January 1 to September 30, 1919, inclusive, to permit him to continue his connection with the Empire State Forest Products Association as forester and secretary. He will resume his regular duties at Ithaca next October.

The Massachusetts Forestry Association plans during the summer of 1919 to make a tour of the National Forests and National Parks, similar in itinerary to the one conducted in 1917. It will be conducted under the direction of Harris A. Reynolds, secretary of the association.

Prof. John Bentley, Jr., of Cornell, expects to devote his period of sabbatic leave, beginning in February, to visiting the various National Forests and experiment stations throughout the Western States, which will occupy him during the spring and summer months.

Prof. John H. Reisner, of the College of Agriculture and Forestry, University of Nanking, China, offers to supply seed of certain Chinese

trees. He would be glad to correspond with any one desiring to obtain the seed of oriental, but particularly Chinese, species, which he is prepared to furnish at reasonable rates.

The Biltmorean, the magazine of the members of the Biltmore Forest School, contains in a combined issue of September and December, 1918, a list of the Biltmore men who were in military service. Eighty-one names are included, but it is stated that there probably should be more additions.

Capt. H. P. Baker has returned to Syracuse and again taken up his work as dean of the New York State College of Forestry. Prof. F. F. Moon, who has been acting dean during Dr. Baker's absence, has been granted a year's leave of absence.

Col. John S. Dennis, C. M. G., president of the Canadian Forestry Association, has been chosen by the Canadian Government as a member of the commission which has charge of the Dominion's commercial interests in Russia.

The cost of fighting fires in the three eastern associations of Quebec—the St. Maurice, the Laurentide, and the Southern St. Lawrence—was only $2,000 in 1918, as against $15,000 in earlier seasons.

Prof. R. C. Bryant resumes his work at Yale with the opening of the second term and will, as usual, have charge of the senior work of the South.

An interim forest authority has been appointed to make preliminary arrangements for developing afforestation in the United Kingdom.

T. S. Zschokke is chief of the division of forest management of the Philippine Bureau of Forestry at Manila.

Dr. H. N. Whitford, of the Yale Forest School, returned in October from a five months' trip to Brazil.

SOCIETY AFFAIRS

To the Members

The great war is at an end and people all over the world have celebrated the old Teutonic festival of Christmas with added joy and interest. The time of the shortest day, of long nights and darkness, is about to give way to a period of the growing day, of more light and joy to all. March storms are still ahead, but in the end spring and summer, with flowers and harvest for all, will greet our race.

Our foresters, like all other groups of good citizens, have earned for themselves the thanks of the nation.

They have not only proven, what was expected, that they were ready, fearless, and capable physically and mentally, but they have repeated the Old World experience, that foresters make the best of soldiers, fit in mind and body, and fit by training and habit as well. Not only in their own line of work, in the 10th and 20th Engineers, but also in regular engineering, in infantry, artillery, and in the Navy, they have demonstrated that a forester's education and training make ready men for many lines of work.

The war has called for great sacrifice. Our small group of foresters, too, had its share, and it is significant that the name of Augsburger should head the roll, as published in *American Forestry*.

But if the war has had its losses, it has also brought its gains. Of great importance to forestry, several points seem to stand out conspicuously.

Today wood is wood, as never before, and there is no longer any question about it. With the experience of Great Britain, her admission that if France had neglected forestry as she has done, the war could not have been fought to the end; with her planting program of 60 million dollars, the importance of wood has come home to all people, in Europe as well as here. That we in this country should add to this experience and have to organize an army to exploit spruce and other timber, in spite of the fact that our country cuts and uses over half of all the saw timber cut and used in the world, this seemed inconceivable. It is all fact now, and the sneer of the big politician who said he was thankful that they had no forests in his State has probably come off for good.

The second great lesson which came home to our people is that simple fact, long known and well known, and yet never really believed nor

acted upon, especially in high places, namely, that it takes land and time and effort to produce a log of oaks or spruce, and that no amount of money and outfit can alter this or even shorten the time.

As a real surprise came the fact that in forestry we differ radically from farming, and that Germany or France, for instance, while living from hand to mouth in agriculture, had 20 and more years' living ahead in timber.

That a better appreciation and understanding of the lumber and timber industries has come to our people through this war will hardly be questioned; and the benefit of this better understanding should help the people and the industry, and should make for a beginning in real forestry on millions of acres of our forest lands.

The wonderful co-operation of State and private effort developed during this war has a far-reaching lesson for our people: it has broken down much of the old bonehead prejudice, the suspicion of business against the State and its ability to do, and, on the other hand, it has taught the State that if real work is to be done, it takes more than a mob of mediocrity, even though "highly recommended by Senator Doe."

But one of the greatest lessons which the war has taught, and most important to forestry, is the fact that the State is infinitely more capable than the private owner. We had this lesson in the Panama Canal, but the people never seemed to appreciate it. "Why, yes; the Government did dig the canal; but what of it? anybody with money could have done it just as well." That this statement is not true and had already been proven false, did not occur to them.

But the war, with its army of millions; its stupendous naval program; its food and fuel regulation; its enormous manufacture and its country-wide wage adjustment; and, above all, its perfect success in every single direction, this counted, and made our people realize its power as a nation. Today the average citizen no longer says, as he did only a few years ago: "Oh, well; it is all politics; the Government is incompetent and wasteful, never gets anything done, and always full of graft," etc.

To forestry, these lessons mean everything, and the outlook for real forestry—for large programs, fearlessly planned and persistently carried out—is better by far than it has ever been in our country.

It should mean better support of our National Forest Service, especially more liberal appropriations, such that good men not merely enter, but also stay, and that the people's property really receives protection and that fires are actually prevented.

It should mean State forestry of the kind where States like New

York, Pennsylvania, the New England and the wealthy Lake States, will not higgle and haggle about a few thousands or argue whether poor mountain and sand lands are not perhaps too good for forestry, when an earnest effort will mean no sacrifice at all, but merely a good and safe investment, and when timber is as much needed as the farm. How far this may go to making all forestry national in scope, like railways and trunk lines of highways, is for the future. The experience of the past 30 years argues strongly for centralization and for co-operation of State and nation.

The great lessons of the war should help to bring forestry to the vast areas of private forest. How much private owners, engaged in their special lines of business, such as lumbering, can and will do is not so clear. The lumberman of Europe is not a forester.

But a great deal can and should be done and done at once. With better forest protection by the State, with fair taxation, with a square deal, allowing the industry a fair return and a just price for its labor, the State and nation should put itself in a position where it may justly and fairly demand that wherever the land calls for a forest cover, the forest must stay, and devastation is "verboten."

Here again comes the matter of men. It is useless to make a lot of fine sounding technical rules and regulations and hand the walking boss a bunch of "sealed orders." It needs men, and we have no right to expect any real forestry or even decent cutting in the forest until we are ready to offer men who have learned the business, know the forest, and love the forest. Such men cannot be had today, and the forester who preaches pessimism and advises against forest schools and discourages young men going into forestry does more harm to forestry than half a dozen good men can make good by their success.

Coming now to the affairs of the Society, but little need be said.

Professor Kirkland's plan of an active committee and a live campaign to find ways and means of furthering forestry with private owners is good, and the time is here to make a beginning.

Similar effort to use the strength of the Society to help in State and national work is urgently needed.

Mr. Boerker has a timely plea for assistance in furthering research and of keeping forestry research not so much "off the rocks" as to keep it from that far more dangerous enemy, "incipient dry rot." We need research and we need a real live brand of it.

Then there is the matter of membership and interest in the Society. We need members, good people, lots of them; we need to stop good foresters dropping out; we need the funds to continue our good paper

and to make it bigger and better. We still wait for the paid secretary, and Mr. Woodward is right and he is still anxious.

The year found a large number of our members in war work, and it was to be expected that the affairs of the Society wait. But in spite of all the doings, the interest in the Society was evident, the contributions to the JOURNAL good and plenty—so much so that the order to save paper prevented the JOURNAL from keeping abreast with the demands for space.

At this point I wish to thank the American Forestry Association and *American Forestry,* and particularly its good editor, Mr. Ridsdale, and President Pack, for their efforts in doing for the foresters in the war; the news, the lists, and the funds did much good; were most thankfully received and appreciated.

I also want to thank the members of the Society and congratulate them.

It was an era of stress and strain; opinions differed, as they always do, and yet there was the most cordial harmony and co-operation throughout this memorable and most trying period. It meant a good deal to your servants, the officers of the Society, and it proved again that foresters are a sane and well-intentioned body of good and dependable citizens.

F. ROTH.

REPORTS OF COMMITTEES.*

REPORT OF THE SECRETARY FOR 1918

Although a momentous year in history, with the death grapple of the titanic struggle brought to an end, it has been without striking events in the Society's affairs. Of necessity this must be largely true of an organization of this character. Most of its leading men were engaged in other capacities in connection with the war, and so engrossed with their special problems and overwhelmed with work that they could give little time to the Society; also many were overseas and elsewhere in military service. In spite of these handicaps the Society as an entity, apart from individual efforts, has taken part in carrying forward the war. Early when hostilities began, or even before, it made a survey

* The Executive Committee, because of its scattered membership (several members being overseas), did not submit any report this year.

The printing of the Treasurer's report is deferred until a later issue, pending the auditing of the Treasurer's books.—ED.

of its men and their capabilities for service in essential specialized lines. The main work was, however, done through its War Committee, especially appointed for the purpose, whose chairman has already presented a report which has developed the feasibility of an important line of work—the timber census. It is understood that this work will be continued by the same committee under another name. In the reconstruction problems upon us the Society has made plans and has done some preliminary work. Doubtless this feature will engage the research committee during the coming year, as it is likely to involve some fundamental and perhaps revolutionary changes, especially in the field of economics and practical trade conditions. Reconstruction forestry, supported by the weight of the Society, with this committee as its spokesman, leader, and organizer, should do much to develop the principles of a new forestry and guide general research along broad and far-reaching lines, as well as throwing light on immediate problems. It is a most attractive field at this stage of world development and social adjustment.

Coming now to more concrete and tangible features of the year's events. One new section was added to our number during the year, making eight in all. This latest comer is the New York Section, with C. R. Pettis, chairman, and A. B. Recknagel, secretary, and headquarters at Albany. It is encouraging to have a new section enter the ranks at so strategic a point for wielding an influence on the forest movement. This effort, it would seem, is well worthy of the Society's commendation. May it not be too much to hope that New England will be the next to enter the field, with a local section organized to take care of forestry interests in that locality.

STATUS OF MEMBERSHIP

There are at present about 350 Active members, 54 Associate members, and 13 Honorary members. Of the above, 40 Senior members, 3 Members, and 6 Associate members were added this year, and there are pending 33 candidates for Senior member, 9 for grade of Member, and 8 for Associate member.

The first election for rank of Fellow held during the year resulted in the following members being raised to that rank:

Hon. Gifford Pinchot	Filibert Roth
Lieut. Col. H. S. Graves	Raphael Zon
Dr. B. E. Fernow	Lieut. Col. W. B. Greeley

There have been 5 deaths:

S. B. Elliott, Honorary member
H. C. Williams (in France), Senior member
T. P. Lukens, Associate member
F. B. Moody, Senior member
J. Roy Harvey, Associate member

Eleven have been dropped for non-payment of dues:

William R. Osborne
J. H. Ramskill
T. H. Sherrard
Dorr Skeels
A. C. McCain
H. C. Neel
Clifford W. McKibbin
Anson E. Cohoon
E. C. Clifford
Wallace I. Hutchinson
W. H. Mast

Six Senior members resigned:

F. W. Reed (1917)
S. St. J. Malven
L. G. Larsen
J. M. Fetherolf
E. M. Griffith
W. B. Barrows

Names of new members elected:

Members

C. Lee Billings
Lewis C. Stockdale
R. Trevor Ferguson

Senior Members

W. R. Barbour
William W. Bennett
E. Murray Bruner
Kenneth M. Clark
Douglas A. Crocker
George L. Drake
Reginald D. Forbes
Samuel V. Fullaway
Richard A. Hamilton
Charles J. Heller
Joseph Kittredge, Jr.
Samuel B. Locke
Charles K. McHarg
Chester B. Morse
Robert J. Noyes
George A. Retan
Ernest C. Rogers†
Robert W. Shields
Herbert A. Smith
Robert C. St. Clair
Victor A. Beede
A. O. Benson
Howard L. Churchill
John L. Cobbs, Jr.
Walter J. Damtoft
Richard C. Eggleston
J. F. Forsythe
Raymond D. Garver
Wilmot G. Hastings
Howard R. Krinbill
Julius A. Larsen
Fred R. Mason
Robert G. Merritt
Willis Munro
Roy G. Pierce
William B. Rice
Earl C. Sanford
Charles D. Simpson
Harold G. Spahr
Stanley L. Wolfe

† Died February 11, 1919.

Associate Members

Homer E. Fenn	Thomas P. Mackenzie
Henry E. Hardtner	I. C. Williams
J. Roy Harvey*	Clarence N. Woods

Action deferred on the following candidates for Honorary membership:

George N. Ostrander	George M. Cornwall

No reply received to notice of election to Senior membership:

Reuben P. Prichard

Candidates rejected for Senior members:

Russell T. Gheen	C. L. Smith

Members who cannot be located (mail returned unclaimed):

Senior Members

O. M. Evans	Arthur M. Cook
Frank I. Rockwell	M. L. Erickson
Frank B. Notestein	James B. Adams

Members in military service abroad (suggest waiving unpaid dues until return):

Senior Members

R. L. Marston	Capt. I. F. Eldredge
Capt. A. C. Ringland	Donald Bruce
W. H. Gibbons	Swift Berry

PUBLICATIONS

The Society has one active publication, the JOURNAL OF FORESTRY, now closing its second year, and also back numbers of two other publications, the *Forestry Quarterly* and *Proceedings of the Society,* 14 volumes of the former and 11 volumes of the latter. The Society now has the entire back set of the *Quarterly,* as volumes 11 to 14, formerly handled by the American Forestry Association, were turned over during the year to this Society.

It is recommended that a special committee be appointed to take an inventory of the back numbers and arrange for their safe-keeping and disposition to good advantage. It should be pointed out that these back numbers are quite an asset, as many libraries and more individuals in

* Deceased.

the future will desire a complete set of the permanent periodical forestry literature of this country and will be glad to pay the small price charged for them. The present year about $135 was received for back numbers. The numbers out of print should be reprinted, so that complete sets of each of the three publications can be supplied.

ADVERTISING

The Society should have an advertising committee and appropriate some funds, if possible, to securing more advertising and more subscriptions. Many manufacturers of wood-working supplies and outing material might advertise, and also more book companies, if the medium was brought to their attention. There are approximately 935 paid subscriptions on the books, of which about 350 are included in membership dues. This list should reach 3,000 in a few years, and might do so in a very short time if the right means were employed and the right people approached.

CLERICAL ASSISTANCE

The routine business of the Society has grown to such a volume, as well as the general correspondence, that regular clerical help is needed to take care of it. There are now eight sections of the Society, the back numbers of three publications, as well as minor ones, to handle, and the publication appears eight times a year instead of four, as formerly.

It is strongly urged that every effort should be made to employ a paid assistant, even if a small assessment is necessary for the present. It will pay in the long run.

It should be remembered that the amount of business of the Society cannot be measured by the past, for a period of reconstruction is here and an era of expansion rapidly coming. The Society should prepare itself to take full advantage of these currents of progress and not lose the opportunity to exert a vast influence on forest and kindred interests, which it cannot fail to do if it secures and maintains a commanding position at this time.

E. R. Hodson, *Secretary.*

Report of the Membership Committee

Owing to unsettled conditions caused by the war, only one list of names was put up for ballot during the year. This made action on proposed members much slower than previously, when lists were put through every few months. However, 49 new members were elected

during the year, distributed by grade as follows: Forty Senior members, 3 Members, and 6 Associate members. Six members were raised to rank of Fellow at the election in February. (See Report of Secretary.)

In addition to those elected, a list of 50 proposed members was submitted—33 for Senior member, 9 for Member, and 8 for Associate member.

In regard to the question of increasing the membership, the following suggestions are submitted to the Society for consideration:

It should be the policy of the Society to elect a large number of men who are qualified to the grade of Member. By so doing many men will automatically become eligible for Senior membership who are now disqualified by the limiting clause of the Constitution, which requires them to serve in the grade of Member for two years. There appears to be no reason why all men who have completed their college work, or in the absence of collegiate training have completed at least three years' work of a creditable character in some branch of forestry, should not become members of the Society. In the course of two or three years these men will have served their apprenticeship as members, whether they have otherwise become eligible for Senior membership or not. Many without this apprenticeship will never, under the Constitution, become eligible for the Senior grade. It is urged that the various Sections and the forest schools secure as many nominations as possible for the grade of Member. These nominations should be accompanied by statements showing that the candidates have the required qualifications.

J. H. Foster,
Member of the Executive Council, in Charge of Admissions.

Report of the War Committee

The War Committee of the Society of American Foresters was reorganized in April, 1918. At that time the President of the Society appointed J. W. Toumey chairman, with power to reorganize and increase the membership and undertake such special work and investigations as might be of value in the conduct of the war. The War Committee was reorganized, with the following executive committee and additional members:

Executive Committee

J. W. Toumey, *Chairman*, Connecticut
Raphael Zon, Washington, D. C.
Gifford Pinchot, Pennsylvania
E. H. Clapp, Washington, D. C.
I. W. Bailey, Massachusetts
C. R. Pettis, New York

Additional Members

S. L. Moore, Florida	R. S. Kellogg, New York
Walter Mulford, California	E. G. Cheyney, Minnesota
P. S. Lovejoy, Michigan	H. H. Chapman, New Mexico
Alfred Gaskill, New Jersey	A. K. Chittenden, Michigan
A. B. Hastings, New Hampshire	A. B. Recknagel, New York
R. S. Maddox, Tennessee.	F. E. Olmsted, California
J. E. Rothery, New York	W. T. Cox, Minnesota
J. W. Sewell, Maine	Hugo Winkenwerder, Washington

With such a large committee, with its members so widely scattered, it was apparent that it would be necessary for its members to work more or less independent of each other. Early in May a communication was sent to each member of the committee, enumerating certain kinds of work and investigation that might have a direct or indirect bearing upon the war or on reconstruction after peace terms were signed. Suggestions and recommendations were also asked for. It was urged that each member of the committee undertake and encourage other foresters in their locality to undertake lines of work bearing upon war activities afforded by their own immediate vicinity. The replies to this communication showed that much work relating to forestry and bearing upon war activities and war industries was already under way by members of this Society. Although it has been impractical for your committee to meet as a whole, there have been meetings of the executive committee and two specific lines of work directly bearing upon war needs have been pursued with considerable success.

Soon after the reorganization of the committee your chairman turned his attention to what he believed most useful at that time, namely, the bringing of foresters seeking employment in war work in communication with army officers needing trained foresters for inspectors and other work. The committee has been instrumental in helping to secure a number of trained men for much-needed war work.

Soon after the declaration of war, difficulties arose in locating available supplies of standing timber of various species and kinds in eastern United States suitable for use in local war industries. Your War Committee believed that if the war continued into the following year a timber census of New England and New York would be of substantial value in the conduct of the war industries located therein. The plan at first was to confine the work to New York and Maine, but later it was extended to all the New England States and New Jersey as well. The work was started by Messrs. Recknagel and Kellogg and Mr. Colby, the Forest Commissioner of Maine, following a conference in

New York City early in the spring. As the magnitude of the work increased, your chairman brought about co-operation with the United States Forest Service, the forest services of several States, and with State forest associations.

The aim has been to secure as complete a list as possible of the owners of fifty acres or more of merchantable timber in each State by countries and towns, and by correspondence with the owners secure from them the acreage, location, and their own estimate of each commercial species in board feet or cords. Although it was realized that any list of timber-land owners that the committee could secure would be incomplete and many owners would or could not comply with the request for estimates, it was felt that the census would bring to light large quantities of merchantable timber of a variety of species that could be utilized for war purposes as necessity arose.

The vast amount of work involved in compiling an acceptable list of owners of merchantable timber in the several States by countries and towns and the sending out of printed forms upon which the estimates were to be tabulated was assumed by A. B. Recknagel, working through the Conservation Commission in New York; H. A. Reynolds, secretary of the Massachusetts Forestry Association; F. H. Colby, Forest Commissioner of Maine; J. B. Mowny, Forest Commissioner of Rhode Island; A. B. Hastings, Acting State Forester of New Hampshire; W. B. Hastings, State Forester of Vermont; W. O. Filley, State Forester of Connecticut, and W. M. Baker, Assistant State Forester of New Jersey. K. M. Clark, of the United States Forest Service, was the active agent through whom co-operation was carried on with the National Government.

The compilation of acceptable lists of timber-land owners was made possible in most States through the assistance rendered by the State tax commissioners and the town assessors.

The following statistical form and letter, prepared for use in Connecticut, is fairly representative of those used in each State:

To Owners of Woodland in Connecticut:

A demand for wood and timber for war purposes makes necessary an inventory of our forest resources. Our Government must know where the different kinds can be found and in what amount. White ash and spruce are needed for airplane wings; black walnut and yellow birch for airplane propellers and gunstocks; oak for shipbuilding; black locust for treenails. Other species are needed for other purposes, or may be in the future, and knowledge of their location is important. Cordwood for fuel will increase in importance if the war continues.

The Society of American Foresters, in co-operation with the U. S. Forest Service and the State Forester, has undertaken to compile the desired informa-

tion. It is a patriotic service in which the co-operation of all woodland owners is necessary. You are therefore asked to give the time and thought required to fill out the enclosed blank.

It is not expected that you will make an exact estimate. All that is necessary is your conservative opinion of the amount, kind, and location of the cordwood and saw timber which you own. List the most important kinds separately and class those of minor importance as miscellaneous.

Bear in mind the purpose of the inventory, which is to bring together facts regarding the available resources of the nation in the form of wood and timber and give all the information you can bearing on the subject. It will be treated as strictly confidential and will not be used for publication except in tabulated form. As it must be compiled at the earliest possible date to be of greatest value, an immediate response is requested and will be greatly appreciated. The enclosed franked envelope requires no postage and should be used for your reply.

Very truly yours,

J. W. Toumey, *Chairman*.

Although the signing of the armistice has made no longer necessary the primary purpose for which the census was undertaken, when completed it will make available much-needed information on the ownership, location, and amount of merchantable lumber by counties and towns in the States where the work has been undertaken and carried out.

On November 12 a conference was held in Boston, which was called for by the men directly concerned with the conduct of the census. The purpose of the conference was to ascertain the progress of the work in each State, to analyze the results that each might benefit by the experience of the others, to have uniformity in the compilation of the data, and to determine on a method of publication of the results of the census. A report was received from each State, with the exception of New Jersey.

Although a complete tabulation of the data is not available as yet in any State where the census has been undertaken, and in New Hampshire the work only continued through the initial stages, the general opinion of the conference was that the work should continue and the census be made as complete as possible, and that it be left to each State to complete the data and determine the manner of publication and presentation to the public. It was appreciated by the conference in Boston that the War Committee of the Society would be soon dissolved, but it was believed important that the timber census should be continued for the benefit of the several States where taken. Your chairman was elected chairman at the Boston conference of a new timber-census committee to continue the timber-census work of the War Committee.

The first fruits of the timber census for New York have already been made available, and the report from Maine will soon be available. The results of this work in Connecticut will be published as a bulletin of the State Forestry Association. It is the hope of your chairman that the results of the census in each State will be published and distributed so far as the data is of public interest. Your chairman wishes to state that the work of your War Committee has been done without any expense whatsoever to the Society.

Respectfully submitted, J. W. TOUMEY.

REPORT OF THE BALTIMORE MEETING OF THE SOCIETY OF AMERICAN FORESTERS, DECEMBER 27 AND 28, 1918

The meeting convened at Johns Hopkins University at 9 a. m., December 27 and 28, with Prof. J. A. Ferguson as chairman. The papers were presented largely according to schedule, as follows:

DECEMBER 27. FORENOON, 9 to 12.30

Forest Reconstruction Problems

Some Remarks on State Forest Policy.................. Prof. R. S. Hosmer
(Received too late to present.)
The Effects of Destructive Lumbering on Labor......... Prof. B. P. Kirkland
(Read by W. O. Filley.)
The Timber Census in Northeastern States............. Prof. A. B. Recknagel
(Read by I. C. Williams.)
The Lumber Industry and its Relation to the War Program.. Prof. R. C. Bryant
(Read by R. S. Kellogg.)
Report of the War Committee......................... Prof. J. W. Toumey

AFTERNOON, 2 to 5.30

Forest Resources

Marketing of Timber from Farm Woodlands........... F. W. Besley
Use of Wood Fuel as a War Measure.................. W. D. Clark
War Lumbering in Scotland—Some Suggestions for American Forest Policy.............................. E. C. Hirst
Some Future Possibilities in Forest Industries.......... Prof. F. F. Moon
(Read by E. F. McCarthy.)
The Structure and Value of Paraná Pine Forests of Brazil.. H. N. Whitford

EVENING, 8.30

Smoker and Round-table Talks on Current Forest Subjects

(F. W. Besley, Leader)

DECEMBER 28. FORENOON, 9 to 12.30

Forest Ecology, Experimental Forestry, etc.

Forest Formations in British Columbia..................	H. N. Whitford
Forest Research and War..............................	E. H. Clapp
Preliminary Results of Forest Experiments in Pennsylvania..	Prof. J. S. Illick
Some Aspects of Silvical Investigations as an After-the-War Activity...	Clyde Leavitt
Factors Controlling the Distribution of Forest Trees in Arizona...	G. A. Pearson
Gray Birch and White Pine Reproduction.............	Prof. J. W. Toumey

AFTERNOON, 2 to 5.30

Business Meeting

The Annual Reports of Officers and other Business of the Society

COMMITTEE ON MEETINGS, *In Charge,*
J. A. FERGUSON, *Chairman.*

Most of the papers brought out considerable profitable discussion, although the time was too limited to permit much discussion for some of the subjects.

A motion was passed that Bryant's paper, entitled "The Lumber Industry and its Relation to the War Program," be printed in the JOURNAL OF FORESTRY; also that the War Committee be continued, under the name of the Timber Census Committee, for the purpose of continuing the census.

A resolutions committee was appointed by the chairman, consisting of Mr. Peters, chairman; Mr. Ayres, Mr. Besley.

The committee drew up the following resolutions, which were adopted by the Society:

I. *Whereas* a sustained timber supply adequate in quantity and diversified in quality is alike essential to national defense in war time and national progress in time of peace; and

Whereas the growing of timber to the larger sizes involves an investment too long in time, with too great hazards and too low a rate of final return for private capital to undertake; and

Whereas only 30 per cent of the present forest area and but little more than 20 per cent of the existing timber stand is in public forests in the United States—a wholly insufficient basis for the future timber supply of the country: therefore be it

Resolved, That the Society of American Foresters urge the immediate initiation of a permanent policy of national and State or other public acquisition of forest land until the acreage of publicly owned land capable of producing timber

is sufficient eventually to supply the bulk of the raw material required by the nation.

II. *Resolved,* That this Society favors a very large extension of silvical research. It approves also the idea of Federal co-operation with other agencies. The Committee on American Forest Research is authorized and directed to take up the matter, on behalf of the Society, with the National Research Council, the American Forestry Association, and any other agencies in a position to help, with a view to securing adequate financial support from the Federal Government along these lines.

III. *Whereas* it has been reported in the newspapers of the State of Wisconsin that an effort will be made to induce the coming legislature to eliminate the provision in the forestry law which requires that one member of the State Conservation Commission must be a technically trained forester of experience; and

Whereas the elimination of the provision will make possible the appointment of a member to succeed the late F. B. Moody, who might be so out of sympathy with the splendid results in forestry already achieved by Wisconsin that the progress made might be seriously arrested; and

Whereas the State could, with advantage, increase rather than lessen its activities in forestry so that Wisconsin might play its proper part, along with other States, in helping to solve the various forest conservation problems which are likely to arise in the reconstruction period:

Resolved, That the Society of American Foresters respectfully urges the maintenance of the present law to appoint a forester who is technically trained to succeed the late F. B. Moody, and that a copy of this resolution be sent to such persons in the State as the President may select, with the suggestion that they take such action as may seem to them appropriate.

IV. *Whereas* there is great need for more forest extension work: be it

Resolved, That the Research Committee of the Society of American Foresters bring before the State Extension Directors and the States' Relations Service of the United States Department of Agriculture this need and present for their consideration a definite program.

Those present at the Baltimore meeting of the Society of American Foresters, December 27 and 28, were:

E. H. Clapp
J. W. Toumey
Barrington Moore
J. A. Ferguson
Willard M. Drake
G. A. Pearson
Ellwood Wilson
Clyde Leavitt
H. N. Whitford
J. S. Illick
C. J. Harris
E. I. Terry
George S. Perry
W. O. Filley
H. S. Newins
I. C. Williams
E. F. McCarthy
J. A. Cope
C. R. Anderson
A. Carl Schroter
E. W. Allen
R. M. Harper
J. C. Nellis
K. E. Pfeiffer
R. S. Kellogg
J. G. Peters
Richard H. Boerker
C. P. Wilber
J. D. Coffman
R. Chapin Jones

F. W. Besley	D. A. Crocker
Philip W. Ayres	W. R. Mattoon
A. H. Pierson	K. W. Woodward
W. Hoyt Weber	E. C. Hirst
I. T. Worthley	Dr. H. L. Shantz
F. A. Gaylord	A. C. Volkmar
W. D. Clark	E. R. Hodson
Alfred Gaskill	R. J. Blair
Paul D. Kelleter	E. N. Munns

The Meetings Committee, to whom great credit is due for the success of the meeting, was composed of the following: J. A. Ferguson, chairman; J. G. Peters, F. W. Besley.

Mr. Besley was the local representative of the committee and looked after the quarters and equipment, as well as arranging for the informal dinner given at the New Howard Hotel on Friday evening, December 27.

At the business session, which followed the completion of the program, the usual routine reports of the officers and standing committees were presented.

At the request of the Permanent Board of Control of Botanical Abstracts, by letter from Donald Reddick, two members—J. S. Illick and Barrington Moore—were appointed to represent the Society on that Board.

At the dinner given on December 27 thirty-seven were present, many of whom took part in the informal discussion on a number of questions of current forest practice and policy. Major Moore gave a greatly appreciated talk on French forestry in war time and led the discussion which followed on that topic.

The meeting was one of the most successful which the Society has ever held, due to the efforts of the Meetings Committee, those on the program, and members generally. About thirty or more were present at all the sessions, and the total number attending was close to fifty. It was noteworthy in another respect that while Forest Service men were present and took part the meeting was made up largely of those outside the Service, from State forester's forces, forest schools, and private forestry. This indicates the growing importance of forestry outside of the Federal Government's work and is a healthy sign. Canada was well represented by three foresters, who took an active part in the discussion and had one paper on the program.

As evidenced by the resolutions passed, the Society takes a keen interest in the welfare of forest matters throughout the country and is prepared to throw the weight of its influence to promote progress by

appropriate and dignified action whenever necessary. In fact, as the collective spokesman of an important profession whose usefulness is rapidly becoming appreciated, it could not well do otherwise.

E. R. HODSON, *Secretary.*

REPORT OF NOMINATING COMMITTEE

The Nominating Committee reports a list of nominations for the several officers for the ensuing year, 1919, as follows:

President:

A. Gaskill
B. P. Kirkland
F. E. Olmsted

Vice-President:

W. W. Ashe
A. K. Chittenden
R. Headley

Secretary:

P. D. Kelleter
W. N. Sparhawk
J. W. Stokes

Treasurer:

E. E. Carter
A. F. Hawes
C. G. Smith

Member of Executive Council:

S. T. Dana
J. H. Foster
C. R. Tillotson

These selections were made without direct consultation between the members of the committee, each member submitting to the other two a list of candidates, to the number of five, for each office, arranged in the order of the member's own personal choice. Final selections as above were then made. In 13 out of 25 preliminary choices of candidates, agreement among the members of the committee was unanimous, which left a margin of candidates to select from where certain men declined to accept nomination. In every case two of the three members agreed on each final selection.

The committee in making its selections endeavored to be guided by the following general principles:

1. To nominate the maximum number of candidates allowable under the constitution to provide as wide a latitude of choice as possible as well as to avoid having it appear that the new officers were being hand-picked by the committee. In order to do this, it was necessary

2. To make as large a number of choices of possible candidates as practicable to whom we could write to know if they would agree to accept nomination. Definite information as to this, it seemed to us, was particularly essential at that time, since doubtless many men would find it necessary to decline for one or another war reason.

3. To avoid, so far as possible, nominating men to the same office which they have already held previously for two or more terms. Until there is a considerably greater dearth of suitable men than now, there should be no difficulty in getting new and acceptable men to fill the offices of president, vice-president, and member of the executive council. With the offices of secretary and treasurer necessarily limited to members resident in Washington, because the files and other impedimenta are there, two considerations were necessary to be borne in mind. The duties of both offices are detailed, onerous, and time consuming, and should not be imposed on a man too long. On the other hand, the work being detailed, the Society's interests suffer from too frequent change, since it takes a man some little time to get onto the ropes. Three to four years is, accordingly, about the limit.

4. To distribute the nominations for the offices of president, vice-president, and member of the executive council as widely as possible, from a geographical standpoint and from the standpoint of the various organized interests from which the membership is drawn—Federal forestry, State forestry, private forestry, forest schools, etc.—so that in the deliberation of the council, of which all officers are members, all shades of opinion would, so far as possible, be represented.

5. To present in our final list of nominations the name of no man who contemplates being absent from the country during the term of the office to which he was to be nominated.

Respectfully submitted by the Nominating Committee,

LOUIS S. MURPHY, *Chairman.*
HERMAN H. CHAPMAN.
WILLIAM G. HOWARD.

OFFICERS AND MEMBERS OF EXECUTIVE COUNCIL FOR 1919

OFFICERS

President—F. E. Olmsted, Palo Alto, California.
Vice-President—W. A. Ashe, Forest Service, Washington, D. C.
Secretary—Paul D. Kelleter, Atlantic Building, Washington, D. C.
Treasurer—A. F. Hawes, Atlantic Building, Washington, D. C.

EXECUTIVE COUNCIL

The Executive Council consists of the above officers and the following members:

S. T. Dana (5 years)
J. W. Toumey (4 years)
H. H. Chapman (3 years)
H. S. Graves (2 years)
R. C. Bryant (1 year)
B. E. Fernow (Chairman of Editorial Board)

Report of the Board of Editors for the Year 1918

During the year no changes have been made in the character of the Journal. The absence of any German literature has, of course, as in the preceding year, curtailed the section of periodical briefs. War activities have preoccupied the time of several of the editors and left reviews in arrears. Moreover, the paper controller's orders curtailed our space and thereby caused delay in bringing out some articles more promptly.

An analysis of the contents shows that 641 pages of articles and reviews were distributed among nine classes of subjects, namely:

	Pages
Botany and zoölogy	7
Forest geography and description	35
Mensuration, finance, and management	113
Politics, education, and legislation	105
Silviculture, protection, and extension	284
Soil, water, and climate	33
Statistics and history	25
Utilization, market, and technology	28
Miscellaneous	11
	641

Special mention should be made of the fact that this volume contains the Terminology of the Lumber Industry, as the previous volume contained the Terminology of Forestry, both of which are for sale separately. The Secretary and the Treasurer have brought in their respective reports the statistics of distribution, cost, and the financial status, all of which are greatly encouraging.

B. E. Fernow,
For the Board of Editors.

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JOURNAL OF FORESTRY

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THE WORK AHEAD

BY FREDERICK E. OLMSTED,

President, Society of American Foresters

While the world is engaged in directing its course along happier ways, the American forester rejoices in the feeling that his profession must play an important part in the great changes to come.

The forester is concerned with the management of a natural resource of distinct importance to the public welfare. The bulk of the forests of the United States are in private ownership and are being used most unwisely from the viewpoint both of the present owners and of the public. Lumbermen, the private owners, are, as a class, distressingly stupid; foresters, so far as the destruction of forests by lumbermen is concerned, are decidedly torpid; forestry in this country is stagnant.

The forester knows about trees, without which life would be uncomfortable. All of us, including the lumberman, know that wood will always be a thing of great value. Trees, as distinguished from other natural resources, such as coal or copper, have a peculiar value, because they are living things and, if decently treated, perpetuate themselves. The forester knows that the forest may be treated in such a decent way that it will produce wood in perpetuity while being cut and manufactured into the many products so essential to the world's comfort and development. The forester knows, as does the lumberman, that if a forest is not decently treated it stops reproducing and dies, becoming of such passing value as the bones of its ancient ancestor, the vein of coal. The forester knows that the kind of management given in the immediate future to forest lands of the United States will have an important influence upon the economic and social growth of the country in years to come. The lumberman refuses to look upon his industry from a viewpoint extending beyond his immediate, individualistic interests, and in stupidly keeping to this narrow outlook he is injuring himself as well as the public. He is killing his forests.

Forestry is the science and art of managing forests in continuity for forest purposes—that is, for wood supplies and forest influences. It

follows that foresters should see to it that those lands of chief value for the production of trees are so managed as to keep on producing trees after they are logged, that we may always have sufficient wood and that the influences of forests—as, for example, that upon the flow of water—may continue to be effective. In this the foresters of the United States have failed to achieve substantial results. We have failed because we have rested with undue satisfaction over past accomplishments instead of keeping clearly in mind what we have not yet accomplished and leading the way toward those ends which must be achieved if forestry in this country is to be a living thing; because we have been timorously blind to the fact that lumbermen, who own most of our forests, are complacently destroying the life of these forests as logging proceeds; and because as foresters we have not placed before the public a definite plan aimed at the stoppage of this waste.

For many years, now, the minds of both foresters and the public have been at peace, under the illusion that, as some one hundred and sixty million acres of forest and brush lands have come into public ownership, our forestry problems are solved. This has indeed been a fine achievement, but only as a start toward the decent management of forests. About 98 per cent of our public forest lands are included in the National Forests of the West, New England, and the Southern States and are owned and administered by the United States. On these lands forestry is practiced; the ripe timber is sold when chances offer, the cuttings are so managed that the lands are kept productive, and systematic protection against fire is in effect. The National Forests are efficiently managed. The timber so owned, however, is largely inaccessible and of relatively poor quality, for it represents the thin milk left after a skimming of the cream by the lumbermen. The National Forests are of value for the grazing of cattle, sheep, and horses; for the conservation of water; and, perhaps, their chief tangible value, even now, is for purposes of recreation. The remaining 2 per cent of publicly owned forests are held by the various States and municipalities. These are almost entirely recreation grounds, and, viewed as a whole, must be considered as parks rather than as forests, where forestry is practiced. In spite of the fact that many of them are in the hands of able foresters, most State Forests are lamentably mismanaged because of the fickleness of State administrations.

Consider, then, one hundred and sixty million acres of publicly owned forest lands, all of undoubted real value to the public, where forestry is practiced as occasion allows. What does this mean in regard to keeping forest lands productive? It means little or nothing. It means that the publicly owned forests, which in general are decently managed and

kept productive, comprise one-fifth of the total standing timber of the country, much of this one-fifth being inaccessible at present; and that the privately owned forests, which in general are stupidly mismanaged and rendered nonproductive, comprise four-fifths of the country's timber, most of which is readily accessible. What is more directly to the point, it means that only 2 per cent of the present annual cut of timber in the United States is derived from publicly owned forests, where forestry is practiced; that 98 per cent of the present annual cut comes from privately owned forests where logged-off lands are turning to wastes or near-wastes. Whence the illusion that we are practicing forestry? It is perfectly evident that we are practicing forestry on the very tip of the tail of the dog. Until privately owned forest lands in this country are decently treated, the nation's loss in forest wealth will continue to be serious and forestry will continue to stagnate.

On this whole question of forestry for the private owner and forestry for the Government we have recently been thinking in a rut. We grant that the Government should practice forestry on its own lands and agree that it is now doing so quite successfully. Then we put the question, "Can the private owner of forest lands practice forestry?" and the pedantic answer is, "Oh, dear, no; he could not afford to wait 80 or 100 years for another crop of timber which might net him 3 or 4 per cent on a somewhat hazardous investment. He might do so, perhaps, if allowed to bring his individual interest into a lumber syndicate of such pregnant power as to rival the Government itself; but existing conditions are indeed most discouraging." And there we have dropped the matter.

That is muddle-headed reasoning. Quite regardless of whether forest lands may be publicly or privately owned in the future or of intricate guesses as to future financial returns, *private forest lands now being logged must be kept productive, for otherwise they will be of no value to any future owner.* We have muddled our minds in the attempt to discover what would happen to the private owner in case the whole science and art of forestry were clapped down upon him, overlooking the fact that *the thing of immediate importance is to make sure that we have forests in the future.* Let us see to it, first of all, that we keep trees growing in order that we may have wood, and then, being assured of wood, let us determine, with all necessary deliberation, who, ultimately, should own and manage the lands upon which this wood is produced. In plain words, this means that the public must compel the lumberman to treat his forests decently, and that the forester, without delay or quibble, must show the public how this may be done.

It is sometimes argued that we do not need to concern ourselves about the forests of the future, because the forests we now have will last us for 50 or 100 years, or even longer; that it is futile to worry about the matter, so long as we have wood. Of course, it is possible to estimate the length of time our present supply of timber will hold out, assuming certain fixed domestic and foreign demands (demands, incidentally, which are by no means fixed). This question has no direct bearing on the problem we are now discussing—that of keeping forest lands productive. Let us suppose, for example, that under certain estimated demands our present forests will last us for a hundred years. That is no reason at all why we should allow cut-over lands to become wastes or near-wastes. In the first place, it takes a hundred years, let us say, for a seedling to grow into a respectable tree, fit for the saw. The trees we are now cutting are, on the average, much older. The time to start our new forests, therefore, is now—not a hundred years from now—for otherwise we should have a long period during which we should be without adequate supplies of timber. In the second place, those who argue that no present action is necessary overlook one of the most vital facts in the whole forest problem, namely, that the destruction of forests in any one locality, district, or region has a distinctly adverse influence on the prosperity of the country as a whole. The forest problem is essentially a local problem.

For example, it is absurd to argue that after the white pine of the Lake States has disappeared the country will be as prosperous as ever, because of the enormous amounts of Douglas fir to be had from the Pacific coast; and that after the Pacific coast stands have been used up we shall jog along as comfortably as ever, because we shall be able to tap the extensive forests of Siberia. Such short-sighted reasoning overlooks entirely the fact that the destruction of forests in the Lake States means an immense industrial loss for that region, and hence for the country as a whole. It means the wiping out of wealth, production, and employment over extensive areas good for nothing but the growing of trees. It should be borne in mind, also, that the accessibility of a timber supply—that is, the ease with which it can be brought to market—is of vast importance from the economic standpoint. Would not the Middle West and the East be immensely better off with an adequate supply of white pine at their very doors rather than to be dependent on some substitute from the Pacific coast or Siberia? The evils of costly transportation have recently been vividly illustrated. The importance of determining precisely how long our present supplies of timber may last has been grossly exaggerated. We know perfectly well

that our forests are disappearing—in some localities rapidly, in others slowly. Our main concern is to keep forest lands productive in all localities, aiming at the general welfare through permanent local prosperity.

Bear in mind that the private owner is harvesting 98 per cent of the yearly cut of timber in the United States and that he is making wastes or near-wastes of his cut-over lands. He must practice forestry to such an extend as may be necessary to keep his logged-off lands producing timber. Is it a practical thing for him to do this? It is. He has not done it heretofore because of his profound inertia, and will not do it in the future until the public takes occasion to disturb his profound inertia. Both occasion and disturbance are long overdue.

The lumberman is holding and paying taxes on his worthless, or near-worthless, cut-over lands on the gambler's chance that "something may turn up" later on to make them of value. Examples have been before him for many years, indicating that he might give them one reasonably assured value from the very start. If he had taken the trouble to investigate he would have found that with little or no increase in his logging costs his lands could have been kept producing trees, thus taking on a definite potential worth which almost from the very beginning could have been discounted to present worth in dollars and cents. If he had taken the trouble to investigate he would have found that any increase in logging costs could usually have been almost entirely counterbalanced by resultant savings in woods and mill. If he had taken the trouble to investigate he would have found, from practical logging operations carried on under forestry methods, that when forests are decently treated they can be made to reproduce themselves on cut-over lands to excellent advantage. The tiresome plea that the long-suffering consumer would have to bear any possible increased cost of production is hardly worth discussion, for such possible increase could be saved many times over if the lumber industry were efficiently instead of inefficiently managed. The decent treatment of forests would be a decided step toward efficiency. Moreover, the private owner of a valuable natural resource, placed entirely at his mercy many years ago through a short-sighted policy of state, is under a distinct obligation to give that resource decent treatment, even if his own immediate profits should be slightly affected thereby; and in case he fails to see this obligation, the public should convince him that it exists.

Cut-over lands, of course, must be protected against fire. Here, again, the cost is nominal, as experience has shown. Moreover, it need hardly be argued that the owner of forest property, whether that prop-

erty be virgin timber or cut-over land, should be compelled to protect it against damage or destruction by fire, for unless he does so his property becomes a public nuisance and should be dealt with accordingly.

The immediate problem before us, therefore, the one problem of vital importance to the advancement of forestry in the United States, is how to plan for and bring about such reasonable management of privately owned forests as will guarantee ample and conveniently accessible supplies of wood for the country in years to come. The question of who ultimately should own the forests of the country must also be solved and solved with all due expedition. Let us not, however, confuse these two problems. The question of future ownership is extremely complicated and cannot be finally settled for many years; the question of keeping forest lands productive is fairly simple and should be settled without delay. As foresters should and must be the guiding and propelling force for better things in forestry, the Society of American Foresters should and must rouse itself from a lethargy bearing many of the earmarks of the lumber industry's inertia. A committee comprising the keenest minds at the Society's disposal, with advisory experts, is now in process of formation. It will be the duty of this committee to plan and direct the Society's efforts for the advancement of forestry in the United States, and every one of us should lend it whole-hearted assistance.

When we come to consider the problem of whether forest lands should be ultimately in private or public ownership, the question should be approached from the standpoint of the best interests of the whole country. It might be determined that the individual owner of forest property could not advantageously serve the public interests in the long run. He is not, as a rule, in a favorable position to invest large sums returning low interest after long periods, assuming hazards which are often serious. It might be concluded that forestry, from its very nature, was an enterprise most favorably handled by collective interests on a large scale. If such a conclusion were reached, we should then face the decision as to whether this collective interest should be a combination of lumbermen or the Government. It has been proposed, for example, that in lieu of Government ownership the lumbermen of the country should be allowed to combine, forming one great association, or syndicate, or trust (the name is immaterial). This would facilitate the borrowing of capital, and the control of production, distribution, and prices, thus placing the lumber industry on a more stable financial basis than at present and offering every inducement for the management of forests in continuity—for the practice of forestry. In return

for such a privilege this proposed trust would agree to conform to certain standards of business management, labor management, forest management, and "treatment of the public," which might as well be called public management. Admission to such a combination and the standards required would be in the hands of various departments of the Government and the organization would be controlled by a board, upon which the Government would be represented to the meager proportionate extent of its own timber holdings. Once organized and instructed, this syndicate would be trusted to work out its own fate and the fate of the public without upper-handed control by the Government.

For years we have been concerned with trees, lumbermen, and the public interest, and past experience offers small encouragement for the success of collective enterprise on any such basis. Success would be doubtful because the lumbermen of this country have proved themselves incapable of managing their own industry efficiently even from the standpoint of their own business interests, to say nothing of the interests of the public; because the management of forests for continuous production, which is of prime importance to the public, if left to the lumbermen would become of secondary importance when conflicting with the greatest immediate financial gain; and, in general, because the control exercised by the Government would be entirely inadequate for the protection of public interests.

Lumbermen are now referred to as a class, the remarks below not holding good for a few exceptional individuals of the trade. A lumberman is one engaged in the felling and shaping of timber. Among the definitions of the verb lumber are the following: "to heap in disorder"; "to move cumbrously along"; "to advance with a rumbling noise." Regardless of the origin of these definitions, they are fairly descriptive of the lumber industry of the United States. It is cumbrous and disorderly, and for many years past has made a great to-do about advancing, without advancing. In certain regions it has made substantial progress in protecting its own properties against fire, being largely driven to it by force of public sentiment. In protecting its own properties it has helped to protect forests in general through the wholesome influence exerted upon the careless, ignorant, and criminal part of the population. From some of its publicity work it might be inferred that in practicing fire prevention it was also practicing forestry or forest conservation, in a broader sense, which has not been true. The prevention of fire is, of course, a vital step preliminary to the practice of forestry, but it is not forestry. Moreover, fire prevention as practiced voluntarily by the lumbermen consists mainly in measures for the pro-

tection of virgin stands of timber to be cut at some future time, and except as an incidental precaution for the protection of such virgin stands, lumbermen have no interest whatsoever in fire prevention on their logged-off areas.

In not a single one of the great timber regions of the country have lumbermen made any sincere, concerted effort to keep their cut-over lands productive. They are still skinning their forest soils to the quick, leaving them wastes or near-wastes, with an eye solely to the immediate dollar. The word skinning may have a familiar sound. It should have, for it was used in this connection more than once by Theodore Roosevelt. It is a much better word than timber-mining and should be brought back into common use. The history of the pine lands of the Lake States is in process of repetition all over the country, and logged-off regions are becoming industrially dead, beyond hope of recovery, except by processes so slow and costly as to be almost beyond consideration. We are speaking, remember, of lands chiefly valuable for the growth of trees, not of those trifling areas of logged-off land which may be turned to agricultural uses. Even those cut-over lands which, wholly undesigned, are left productive in a small measure represent an enormous potential loss in future production and employment.

Labor, the world over, is in a state of unrest. We in this country have had a touch of extremism from the I. W. W., an organization which all of us would like to see disappear. Perhaps one of the simplest ways to make it disappear would be to do away with the causes of which it is a symptom. The lumber industry, as much as any other, has been to blame for the existence and growth of the I. W. W. The causes have been abominable living conditions, long hours, under-pay, temporary employment, and the creation of industrial wastes through the destruction of the source of raw material.

The lumber industry is many years behind the times in business intelligence and organization. It guesses at the amount and value of its raw material; its plans for logging, transporting, and milling this raw material are haphazard; its knowledge of the real cost of manufacturing its product is ridiculously vague; its accounting systems are extremely crude; its understanding of the uses to which its products are put is childlike, and its fancy as to the amount and value of its stock on hand at any given time is susceptible to wide variations. It is interested in its own business chiefly from the narrow standpoint of plant against plant, region against region. It still clings to the excuse that it is a "pioneer" industry. It is; for it is endeavoring to do business on a pioneer basis long after pioneer days have passed it by. It

is a pioneer in laissez-faire. The industry has, to be sure, made a notable advance in mechanical appliances for logging and milling, which has resulted both in decreased costs of manufacture and in enormous overproduction of manufactured materials. In the woods such appliances have generally resulted in increased forest destruction. The industry as a whole is archaic, individually self-centered, and penny-wise. If lumbermen are ever permitted to combine in restraint of trade, the United States Government should be the undisputed and ever-active boss of the industry so combined, and perhaps the simplest way for the Government to make sure of its control would be to own the great bulk of the raw material, the timber.

For many years past the forester has endeavored to persuade the lumberman that measures for keeping his lands productive were worth adopting. Persuasion has utterly failed, resulting in little more than mild amusement on the lumberman's part. The lumberman, to be sure, has always expressed a keen desire to "co-operate" with the forester in all ways possible; but the difficulty there has been that in practice the lumberman's understanding of co-operation has been to accept everything to his immediate liking and to yield nothing in return. Precisely at the point where the forester's suggestions imply a present restraint on the lumberman's part in order to insure the future welfare of both the public and the lumberman, the forester becomes a theorist, an idealist, and what chambers of commerce are pleased to term an "insidious influence." The humor of the situation is that the lumber industry has fallen to its present level because of a total lack of theory and ideals. The time for persuasion has passed.

These are the two tasks before us which overshadow all others: First, to compel the private owner of forest lands to keep his soils productive. Second, to reach a clear-cut conclusion as to whether the bulk of timber producing lands should rest ultimately in private or public ownership; if in private ownership, under what system and control; if in public ownership, through what procedure. The first task is far and away of greatest immediate importance. Have we anything more worth while to think about, write about, and act upon?

THE ORGANIZATION OF FINANCE IN FOREST INDUSTRY

By Burt P. Kirkland

University of Washington, College of Forestry

GENERAL CONSIDERATIONS

Owing to the short period of participation by America in the great war, reconstruction may not be as radical a process as must be faced by Europe. Certainly, however, many changes overdue before the war must be brought about to place industrial and social conditions on a stable footing. Inasmuch as forest industry was recognized as one of the most unstable, it must receive a large share of attention. This becomes all the more urgent in view of the paramount importance our forests have in war or peace. Furthermore, it can scarcely have escaped the attention of the most unthinking that our natural resources are after all severely limited. It follows that no man with honest desire for his country's continued welfare can refuse support to sound measures of improvement in handling our forests. Nevertheless, either through inability to grasp a unified program of forest betterment or reluctance to undertake thoroughgoing measures at one leap, it is probable that necessary changes will be undertaken piecemeal. This discussion is therefore confined to one item of possible improvement, which is, however, of a most necessary nature, namely, improvement in the organization of financial credit.

AMOUNT OF CAPITAL REQUIRED BY FOREST INDUSTRY AND INTEREST RATES AVAILABLE

The necessity for this improvement is very evident. Investigations of the U. S. Forest Service conducted in 1915 disclose that 30 to 50 per cent of the capital used in forest industry is borrowed, and that interest rates vary from 5 to 8 per cent, with an average of at least 6½ per cent, or even more, when the cost of securing loans is added.[1, 2, 3] According-

[1] Report No. 114, U. S. Dept. Agriculture: "Some Public and Economic Aspects of the Lumber Industry," by W. B. Greeley, pp. 14-15.

[2] West Coast Lumberman, November 1, 1916, p. 34.

[3] Journal of Forestry, January, 1917: "Continuous Forest Production of Publicly Owned Timberlands as a Solution of the Economic Difficulties of the Lumber Industry, by Burt P. Kirkland, pp. 12 and 15.

ing to report of the Department of Commerce and Labor,[4] private investment in timber in this country amounts to not less than six billion dollars before the war. No doubt capitalization has increased with rising prices. The value of logging camps and sawmills adds about one billion dollars more to the capital investment in the lumber industry, making a total of about seven billion dollars, without counting capital used in distribution of lumber. It is no discredit to the industry that a large amount of this capital is borrowed. On the contrary, so long as our present system of industry is continued, it is of paramount importance that active managers of industry borrow the capital of those no longer able to manage industry, including that of the "widow and orphan." Borrowing in any sound industry should probably amount to 40 or 50 per cent of all the capital used. This permits a shrinkage of 50 to 60 per cent in the assets of the industry without jeopardizing the lender's investment, providing the credit instruments have been properly framed and the borrowing properly organized. The assets of forest industry are of such stable and permanent character that there is no possibility of a 50 per cent shrinkage. There is indeed little or no possibility of a shrinkage of even 25 per cent in the assets of this industry, but it is inadvisable, both from the standpoint of the borrower and lender, to finance as much as 75 per cent of the assets on borrowed capital with long-time loans, because temporary interruptions of income, as in time of depression, may interfere with interest payments and disrupt the necessary relations of confidence between borrower and lender. Moreover, it is economically unsound for the enterpriser to be relieved of the necessity of employing considerable of his own capital in his own enterprise, or at least to be under immediate supervision of those who advance capital (the stockholders). To do so relieves him of a large part of the incentive to conservation and close attention to business detail necessary for the best results. The sound business should be able to command short-term credit to cover the ups and downs of business to the extent at times of perhaps 25 per cent more of the capital employed, but this credit should probably come through ordinary banking channels, as at present.

AMOUNT OF CAPITAL BORROWED AND SAVINGS BY ORGANIZATIONS OF CREDIT

This discussion concerns itself with the 40 to 50 per cent of capital which is being or should be secured through long-term loans. With an investment of seven billion dollars, borrowings of this percentage would

[4] The Lumber Industry, Part I, p. 1*a*.

amount to from about three to three and one-half billion dollars. Taking the smaller figure, the interest bill of the industry, at the present rate of almost 7 per cent, must be in the neighborhood of $210,000,000 annually. With proper organization of forest-industry credit, interest rates should shrink until comparable to the rates secured by other industries with properly organized credit, although with often less sound assets. Our railroads secure capital at 4 to 4½ per cent, and at this writing U. S. steel 5's are quoted at par. Forest industry should not pay to exceed an average of 5 per cent, at which rate the above interest bill would be reduced to $150,000,000 per annum—a saving of $60,000,000 annually. This does not read large after examining a report on sums squandered on airplane production; but we can better understand the magnitude of such a saving when we reflect that it is twelve times the amount spent annually by the Forest Service in managing the National Forests. *It is also probably four times the amount necessary to regenerate by natural means, supplemented by some artificial aid, all commercial forest areas annually cut over in the United States, and protect forests in commercial forest regions from fire.* Such a saving is therefore of the utmost importance to forests and forestry.

REASONS FOR PRESENT HIGH INTEREST RATES

Before addressing ourselves to the method of making this saving, the question arises as to why the interest rates are higher in forest industry than other industries, often with less stable assets? High interest rates arise in forest industry because of speculative reputation of industry, high cost of investigating loans, small individual borrowings by unorganized borrowers competing with each other for capital, and other minor factors. The conditions are very nearly identical with those maintaining in farm borrowings. All these disabilities of forest industry as a borrower can be removed in large measure by organization if Americans will exercise some of that genius with which they freely credit themselves. It is unlikely, however, that the industry possesses entirely within its own ranks the requisite initiative and powers to organize effectively for this purpose. It will need aid of an impartial public agency, and, since the organization must be national, it must be a national agency. Fortunately, there is ample precedent for such Federal organization, specifically, in the Farm Loan Board and, in a general way, the Federal Reserve Board.

SAVINGS TO BE MADE BY ORGANIZATION OF CREDIT, NOT BY FEDERAL SUBSIDY

Briefly, then, a Federal Forest Loan Board is needed to organize the credit resources of forest industry to secure cheaper capital. We may pause here to pay our respects to those financial interests which profit by abnormal interest rates and financial chaos. These heretofore privileged interests have charged in connection with the Federal Farm Loan Board that the scheme constituted a paternalistic subsidy to the farmer. Similar charges may be expected in connection with a Federal Forest Loan Board. *This occasion is therefore taken to repudiate any such charges. Neither the Federal farm-loan policy nor the proposed forest-loan policy involve paternalism or subsidy to the industries involved. These policies should be taken squarely at face value. Through them the Government does for these industries what it should stand in position to do for any necessary industry, namely, assist in the creation of financial institutions suited to the specific needs of each industry and operated by men with knowledge of those specific needs.* Some capital may properly be advanced temporarily by the Government, as in the case of formation of the farm-loan banks, which had small advances for purposes of organization. On account of the war some farm-loan bonds were also taken by the Treasury. Farm loan $4\frac{1}{2}$ per cent bonds are now selling at a premium on their own merits, and some of the banks are now ready to return money advanced for their stocks by the Government. The advance of Government funds is only temporary and is beside the real purpose of the farm-loan act, the main purpose of which is to *organize farm credit.*

SCOPE OF LOAN POLICY

Although the Federal Farm Loan Board serves as an example of what is needed in forest industry, it cannot be said to fully meet the requirements, the main defect being overconservatism in its loan policy, which may, however, be pardoned during the early period of development, though there is extreme danger that this policy will become fixed. *The valid objection to overconservatism becomes clear when we reflect that the products of industry required by society cannot be secured in adequate amount without taking risks in industry. This being true, it is axiomatic that the obligation rests on society to create financial institutions capable of absorbing an adequate portion of the risk instead of*

leaving all on the individual, as does the Federal Farm Loan Board under its policy. To date we have induced the individual to take all the risks by promising high rewards for success. This system ruins some and makes millionaires of others. Happiness will be more general with fewer of each class in evidence. This result can be facilitated by institutions which will absorb some of the risks in industry, so that smaller rewards need to be offered to secure production. The solution of this problem, so far as it concerns finance, is relatively simple. Since the interest rate consists of three elements—(*a*) payment for the use of capital itself, (*b*) the cost of investigating the loan, and (*c*) payment to cover the element of risk—in the present 7 per cent rate on forest loans perhaps 3 to 4 per cent represents value of use of the capital, ¼ to 1 per cent cost of investigating the security and preparing the loans, and 2 to 3 per cent to cover risk. Proper organization of credit will eliminate part of the cost of investigating loans and much of the risk element, except in certain loans necessary to the industry, but inherently risky. These are taken care of by increased interest rates, as considered below.

This brings us to consideration of the proper constitution of a Forest Loan Board and a brief statement of its methods.

MAKE-UP OF FOREST LOAN BOARD

The board should consist of five to seven members appointed by the President. Part of these members might well represent such present governmental organizations as the Treasury Department, Forest Service, Department of Commerce, etc., and the remainder be selected from representatives of forest industry. Its duties should be to fix the general policies and supervise the operation of the Forest Loan Banks.

REGIONAL ORGANIZATION OF BANKS

The plan of organization should provide for decentralization, as in the Federal Reserve and Farm Loan Banks. The country should be divided into eight or more districts, as, for example, (1) New England and Northern New York; (2) the Lake States; (3) the Central Hardwood and Appalachian Region; (4) the Southeast; (5) the Northern Rocky Mountains; (6) the Southern Rocky Mountains; (7) the South Pacific Coast; (8) the North Pacific Coast. Further subdivision may be desirable. Each regional bank should reflect the local viewpoint and have a full staff of forestry, timber, and financial experts.

FUNCTIONAL ORGANIZATION

On account of the various classes of loans to be placed, the banks should be functionally organized into the following divisions, the functions of each of which is obvious, when considered in connection with the classes of loans later dealt with:

(*a*) Division of Public Forest Loans, whose duty shall be to pass on applications of municipalities, States, and Federal departments for loans on forest properties presumably worked for continuous forest production. Federal loans are included here, because there is no reason why such great properties as the National Forests should not finance themselves without recourse to tax moneys.

(*b*) Division of Private Forest Loans.—Continuous production forest.

(*c*) Division of Private Forest Loans.—Exploitation forest.

(*d*) Division of Forest Utilization Loans.—To loan on sawmills, logging developments, pulp and paper, and other wood utilization industry plants.

(*e*) Division of Receiverships.—Any financial institution which loans adequately to any industry will have to foreclose some mortgages. The division of receivership should close out or operate such properties until such time as they will close out with the least loss. In accordance with the social purpose of such an institution as this, special effort should be made by this division to put bankrupted exploitation forests into the hands of owners who will put them on a continuous production basis, as, for example, the Federal Government, States, or municipalities. This division, by reason of its close relations with other divisions having power to make loans, would be in position to place forest properties in hands where they will be best managed.

SECURITIES RECEIVED AND ISSUED

The Federal Forest Loan Banks should advance capital to the various units of forest industry under suitable restrictions, considered in more detail hereafter, and receive first mortgages as security therefor. These relatively small mortgages should be used as collateral for large bond issues which will be marketable in the bond markets of the world, as no timber bond issue now is. Such bonds are desirable as investments because of their marketability, stable value, and continuous income yield.

VARIATION IN INTEREST RATES

It should be most specifically stated that the financial institution will fail of its purpose if it establishes one set rate of interest for all classes of loans, as has been done by the Federal Farm Loan Board. Interest rates should be fixed with some degree of flexibility, just as the Federal Reserve Banks give preferred discount rates on certain classes of security. The principles under which interest rates should vary are partially discussed below.

Of three elements going to make up the interest rate—(1) a percentage to cover the bare value of the capital if loaned without cost of investigation or risk (a condition closely approximated in loans to the Federal Government), (2) a percentage to cover cost of investigating the loan, and (3) a percentage to cover risk—the first may be considered constant as between loans on the same date and variable only by periods of time. The second possesses considerable variation, but the third is the principal variable, varying from nothing in loans to the Federal Government to 100 per cent in loans to some mining companies. It is by considering this element of risk that the Forest Loan Board can serve all parts of forest industry with capital in complete safety. If experience shows that in sawmilling 1 per cent of loaned capital is lost through industrial failures, then the risk part of the interest rate to sawmill concerns must not be under 1 per cent. If less tried wood-using plants, such as ethyl alcohol plants, lose 3 per cent of borrowed capital through industrial failures, then loans to this class must add 3 per cent to the base rate to cover risk. If the base rate (rate at which the capital is borrowed in open market) be 4 per cent, the cost of administration and investigation of the loan ½ per cent, and the risk 3 per cent, then the total rate to such an industry would be 7½ per cent. In a loan on the National Forests risk would be entirely eliminated and cost of investigation and administration nearly so. Hence the rate would be reduced practically to base rate and should not exceed 4⅛ per cent or less. It should also be remembered that it is not worth while for the public to lend its aid in the establishment of such a financial institution unless it serves a social purpose. In this case it should aid in the perpetuation of the forest for national use and help in bettering the conditions under which employer and employee live and work together.

Enterprises best securing social ends may *thus properly receive favored treatment in interest rates,*[5] so far as consistent with sound finance. Fortunately, such enterprises, as a rule, present the least

financial risks, and are entitled to lower interest rates for this reason, also. For example, a forest under efficient continuous production management does not depreciate, but continues to maintain or increase its value. It is entitled to a lower interest rate than an exploitation forest, whose value is dissipated as cutting progresses, oftentimes under conditions which forbid setting aside sufficient sums to repay borrowed money. Concerns creating favorable conditions for labor may well receive more favorable interest rates along the lines previously suggested by the writer.[5] This is strictly sound finance, because industrial experience has amply shown that such concerns are on a basis of more stable income, that "being human is good business."

INTEREST RATES ACCORDED DIFFERENT CLASSES OF LOANS

Under the principles set forth in the preceding paragraphs, the writer conceives that various forest properties and industries are entitled to consideration in interest rates in approximately the following order:

(1) Forests under continuous production management in the hands of the Federal Government, States, and municipalities, where the general public credit, as well as the properties, are pledged, say, 4 per cent interest (when interest rates are normal).

(2) Similar forests where only the properties themselves are pledged as security, 4½ per cent interest.

(3) Privately owned continuous production forests, 4½ to 5 per cent.

(4) Private exploitation forest, where the bonds must be retired serially as the timber is cut, 5 to 5½ per cent.

(5) Sawmills, pulp and paper mills, wood-distillation plants, and other proven industries supplied by forests managed under continuous production, hence guaranteeing permanent supply of raw material, 5 to 6 per cent.

(6) Similar plants dependent on exploitation forests, where supply of raw material will be uncertain, 6 to 8 per cent.

(7) Less-proven industries dependent on continuous production forests, 6 to 8 per cent.

(8) Similar industries dependent on exploitation forests, not loanable.

LOAN RESTRICTIONS

A few necessary restrictions on certain classes of loans may be mentioned. Continuous-production forests should, obviously, have first call on loan capital. The most urgent restriction should be exercised

[5] Journal of Forestry, January, 1917, pp. 32 and 33.

in the case of loans to wood-working industries. *Loans should not be made to more plants in one locality or in the nation than are needed to supply the local or national markets.* The rule here should be first come, first served, unless some plants are unloadable through bad location or construction and arrangement.

In closing, the writer wishes to urge that the time was never more favorable than now for the formation of such an institution. In the next series of years the Federal Government will be paying off some 16 billions of low-interest-bearing bonds, thus rendering available to lenders some five times the sum necessary to cover the legitimate borrowing requirements of forest industry. No more opportune time could be imagined than this for floating all bonds necessary. It should also be again emphasized that the principle of decentralization must be strictly adhered to. Complete freedom of action must be left to all borrowers in order that freedom of initiative which has served so well in the past may continue to do so in the future. No restrictions should be placed on securing loans from other sources.

The attempt of the Federal Government to dictate industrial methods would be a sure bar to progress and hence intolerable. It has perfect freedom to excel in management of its own forest holdings and is under no necessity to interfere elsewhere. The argument for the proposed financial institution may be closed with the positive declaration that if the Federal Government does not by its aid in organization of financial and other institutions bring order out of chaos in forest industry now, which it can do at insignificant expense, it will later have to spend billions for reclamation of forest areas now being denuded of forest growth, with no care to the future.

REVIEW OF LUMBER INDUSTRY AFFAIRS

By P. S. Lovejoy,

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The following survey of discussions, appearing in the lumber trade journals during the last half of 1918, is an attempt to sketch current events and economic conditions which promise to be of some permanent importance and with which it may be well for foresters to keep in touch, so that they may maintain an intelligent understanding of the point of view of lumbermen.

GOVERNMENT REGULATION OF THE LUMBER INDUSTRY

In common with other industries during the war, the producers of forest products were subjected to more rigorous supervision and more radical and particularized control than could well have been imagined.

This control centered in the War Industries Board, and especially in the Lumber Section. The personnel of the war organizations was drafted, almost without exception, from the field of successful industry, and professional politicians or representatives of the old line of Washington bureaus were notable in their absence. We had, in fact, a business-man's administration, in which business men for the time ordered the business of the nation.

It is noteworthy that no large projects seem to have been inhibited or seriously delayed by lack of essential forest products, and the lumbermen of the nation can well congratulate themselves on their accomplishment.

To be sure, serious friction did develop at times, as in the case of the vehicle makers and hardwood manufacturers, and again over price fixation in southern pine; but these difficulties were of short duration.

In spite of the success with which a series of very trying situations was met by the industry, the lumber industry, in common with others, did not reconcile itself to governmental regulation, even though administered by business men from its own ranks. The general sentiment seems to have been voiced by the convention of Wholesale Lumber Distributors, at Chicago, on November 23, the resolutions of which read in part:

"For the good of the industry, the Government should discontinue and eliminate the restrictions and price-fixing on lumber products. . . . Government efforts should be directed to furthering trade, based upon the law of supply and demand, in opening commercial channels."

The rapidity with which price fixation, regulation, and embargoes, building restrictions, etc., have been discontinued indicates the intentions of the Government to proceed along the lines indicated.

There are signs that post-war developments in the way of a national policy in respect to essential raw materials may be expected, but there is no present indication as to how such legislation or such policies may affect the lumber industry. Today the industry is, to a very large degree, in *status quo ante*. The amount of the purchases by the allied governments and their desires in this matter will, doubtless, in a large degree, determine the amount and form of Government control during the next few years.

LUMBER EXPORT

The possibilities of export business are being canvassed by American and Canadian lumbermen with great enthusiasm, and interest in the forest conditions of foreign countries is widespread. Various organizations, as notably the Northern Hardwood and Hemlock and the American Hardwood Associations, have already fairly detailed plans for the development of export organizations. Perhaps no other subject has been so generally discussed by the trade journals during the midwinter months. This interest seems to be derived from the idea that domestic markets are failing or at least inadequate to absorb the current production of lumber and the idea that foreign trade may be expected to be more profitable than domestic. Detailed evidence or cogent reasoning on either point seems generally wanting.

The *Lumber Trade Journal*, however (December 9, 1918), expresses itself unequivocally, as follows:

> "For nearly three years we have been confronted with the stubborn fact that we actually import more lumber and timber products of all kinds than we export.
>
> "There is an even chance that this situation will continue to grow upon us until, instead of seeking an outside market for timber, we will be seeking an outside supply to help supply our domestic needs. . . .
>
> "All authorities agree that, at the rate we have been going for a number of years, we will eventually reach a point where there will not be enough timber stumpage to supply domestic needs, unless the needs are cut down or some way is discovered to make the stumpage go much farther. . . .
>
> "This is a situation which should furnish food for much thought on the part of those prominent in lumber production in this country."

The Atlantic City meeting of the Chamber of Commerce of the United States, in December, 1918, made somewhat vague reference to the desirability of paying attention to essential raw materials, but for-

mulated nothing definite in the way of a policy, in spite of the fact that lumbermen were well represented.

In this connection it is interesting to note that the War Trade Board, in April, addressing southern hardwood interests, is quoted as saying:

"We wish to advise that no white-oak railroad ties or white-oak ship timber will be permitted export from this country except where they are needed for war purposes.

"We are determined to preserve our white oak for furniture manufacture, agricultural implements manufacture, and numerous other industries in this country and Canada . . . as all other hardwoods are disappearing, and oak, especially white oak, is to be the mainstay of the above industries for the future" (*Hardwood Record,* May 10, 1918).

Information is not available to indicate the basis for the War Trade Board decision or why other species of timber should not have received similar treatment, as, for instance, hickory and ash. The situation offers interesting possibilities. There may be methods of "conservation" not yet proposed and more practicable than some of those previously attempted.

In addressing the National Wholesale Lumber Distributors, at Chicago, Prof. R. C. Bryant, who was in charge of the Forest Service study of the lumber industry during the war, is quoted as saying:

"Indications point to a much reduced lumber cut during the coming year. Taking the country over, the decrease from normal will amount to several billion feet, and production will hardly recover the normal basis for a year or two."

He indicated that about five billion feet would be the maximum footage allowable for export, the balance being required at home (*American Lumberman,* November 23, 1918).

SOUTHERN PINE PASSED ITS PEAK

While the statistics of lumber production have for several years read rather plainly, and while those in touch with the situation could not doubt but that the South was rapidly duplicating the procedure of the Lake States, definite and official confirmation of the current situation has been lacking.

In July, before a meeting of West Coast lumbermen, President J. H. Kirby, of the National Lumber Manufacturers' Association, made statements which may be startling even to those who have been watching the course of events and which are worthy of consideration from yet other angles. If President Kirby's figures are correct, the situation is even more acute than the most rabid "Pinchoist" might have thought.

Mr. Kirby is quoted as saying, in part:

"You will be here long after the rest of us have junked our mills and have gone into other employment, but you will not be here forever. . . . Just a short time ago . . . from St. Louis to Maine was one vast forest. The forests of Michigan, Wisconsin, and Minnesota were regarded as inexhaustible . . . yet . . . all that country is producing only a straggling little bit of timber. . . . Those wonderful forests are on their last legs, a few fringes left.

"There is not a tract of forest of any size in all the South today that is not owned by some operator or held for operating. Fifteen years ago outside investors . . . owned practically all of the southern forests . . . but about fifteen years ago the lumbermen of the South suddenly awakened to the knowledge that their forests were rapidly disappearing. They began to investigate, and when they did, they saw the limit of the forests and they rushed into the market and bought up all that was left; so that today, in the South, you have only a fringe of forest. Here and there a little.

"Of the 362 sawmills in Texas, 202 answered a questionnaire asking as to the quantity of timber owned. Of the 202 mills making reply, 90 per cent had shorter life than five years; so that if you men here have the idea that your industry is going to be permanent, get it out of your mind. . . . All intermediate territory, everything between Illinois and the Atlantic, all the world, substantially, has got to be supplied from the Pacific coast in a little while. . . .

"You are going to have a profitable business, and within five years you will havehave substantially no competition, save local competition among yourselves.

"I am pointing to this to lead you to a certain thought. You think, perhaps, that your stumpage is high. . . . Within the period of my life, . . . in eastern Texas, my father traded 320 acres of yellow pine for a sewing-machine.

"Under these circumstances, why don't you get behind the National Association? You owe it to yourself to put your industry on a high plane and get together for the good of every one. You owe it to your country . . . your section, to the men you employ . . . to yourself, to your neighbor, to your country, and your God, to think and act in a big way. . . . You are asked to extend a little more generous assistance to the National. In fact, to double your contribution . . . I ask for this support. For every five cents invested you will get back a dollar" (*Lumber Trade Journal*, August 15, 1918, page 23).

Further and confirmatory evidence as to the southern pine situation was given by J. E. Rhodes, Secretary and Manager of the Southern Pine Association, before a meeting of southern foresters at Jacksonville, Fla., on January 3. He is quoted as saying:

"In five to eight years at least 3,000 sawmills in the South will be cut out, and at the present rate of cut, the annual production will drop from around eight billion feet to three or five billion feet" (*Lumber Trade Journal*, January 15, page 19).

"Trade Extension" is the term currently preferred to "advertising" or "exploitation," and the rapidity with which it increases in the lumber industry presents a decided anomaly, with log timber supplies

shrinking as they are known to be and with timber as essential as it certainly is. That the manufacturers should find it profitable, and presumably necessary, to invest great sums in advertising their product is certainly worthy of attention. Evidently they have agreed with Thelen ("Substitution of Other Material for Wood," 1917), that "lumber is no longer a necessity and must be sold in competition with other materials; hence merchandising methods at least as modern and efficient as those of its competitors are necessary. This involves effective advertising."

But the world's recent experience would seem to contradict such a conclusion, and this feeling is editorially expressed by the *Lumber Trade Journal* (September 1, 1918, page 13): "The welfare of mankind, in peace or war, demands the use of lumber, regardless of the price is has or may maintain."

In any case the Cypress Association has increased its assessment from 20 to 50 cents per thousand feet, and plans an even greater publicity campaign than that of its past, and a committee report to the American Hardwood Association, principally interested in southern hardwoods, recommends that "we should not play second fiddle to cypress," and urges a budget of $50,000 for gum and $100,000 for oak, equivalent to an assessment of about 12½ and 33⅓ cents per thousand respectively (*American Lumberman,* December 21, 1918, page 37).

It should also be noted that a Wood Wheel Manufacturers' Association has come into existence and has initiated an extensive campaign in the national magazines.

Further, that a very large southern pine concern has done likewise, in effect trade-marking its lumber, each piece of which, it seems, is to bear the firm stencil—certainly an innovation without precedent.

The National Lumber Manufacturers' Association has proposed a budget for the current year in which $60,000 out of a total of $132,000 is for the Trade Extension Department (concerning which see the remarks of President Kirby to the West Coast lumbermen in July, as previously noted). For itemized budget, see *Lumber,* October 21, 1918.

ASSOCIATED LUMBERMEN ASK FOR ADEQUATE CENSUS

On November 23, acting upon a suggestion of the War Industries Board and under the auspices of the National Lumber Manufacturers' Association, probably the largest meeting of lumbermen ever assembled took place in Chicago. Some 32 regional associations and upward of 1,000 individuals were present. Problems of "reconstruction" were principally considered. The resolutions adopted included two of par-

ticular interest to foresters. One expressed appreciation of the work of the Madison Laboratory and requested Congress to continue adequate funds for its work. The other recites that:

> "A census of standing timber classified by species, location, and accessibility—a census of cut-over lands that will remain temporarily or permanently forest—would secure to the lumber industry information important in the conduct of its business, would afford a basis for the interpretation of economic problems in forest and wood-using industries, and would aid the development of a permanent national forest policy in respect to timber ownership, lumber export, tariff, local taxation, value of stumpage, and sundry forest problems."

Congress is urged to make such a census possible.

Few matters of national economics and nothing in the field of forestry is second in urgency or far-reaching importance to the proposed census. As Sargent's work in the Tenth Census first proved the suspicions of a few "cranks," and as the work of the Bureau of Corporations in 1913 demonstrated in full the contentions of the small group of "conservationists," and as both were promptly reflected in national policy and legislation, so the new, and for the first time adequate, timber census may be expected to present our national forest status in a manner certain to accelerate enormously the interests of foresters and, of course, the permanent interests of the lumber industry.

It is to be hoped that the census may also include more adequate inventory of the woodlots of the country than has yet been secured.

Foresters should certainly leave no stone unturned in supporting the lumberman's Chicago resolution.

LUMBERMEN WANT DEPENDABLE STATISTICS

A somewhat tardy, perhaps, but none the less real, appreciation of the urgent need for an adequate consideration of forest economics is indicated by a report to the directors of the National Lumber Manufacturers' Association. The report, which was adopted, calls for an organization to study and make available the base data of the industry.

> "We want to know the amount of our investment and that of the industry; how much timber we have and the amount of timber owned and controlled by the industry; the value of our timber; the cost of production; a cost system that is uniform; the available supply of timber in stocks and production; the prices obtained for our product. In other words, we should build within this body a bureau of lumber economics in the same way the railroads have established a bureau of railroad economics. We may witness the Federal Trade Commission making an effort to secure this information as the Interstate Railroad Commission does for the railroads. But the railroads found it desirable and advisable to establish their own bureau, and for the same reason we should have a check upon these figures as well as the information itself."

A policy of interchange of statistical information and economic views with lumber administrators of other countries and co-operation with the Census Bureau, the Federal Trade Commission, the Forest Service, and the War Industries Board is recommended (*American Lumberman,* August 3, 1918).

For a detailed statement of the data desired and the *modus operandi* proposed, see *American Lumberman,* October 12, 1918, page 44.

LUMBER BUSINESS ACCOUNTING

Federal investigation, price-fixing, and tax requirements, as well as general business conditions, combine to enforce a uniform cost accounting system and practice upon a somewhat hesitant lumber industry. Dr. Wilson Compton (an ex-Professor of Economics and lately with the Federal Trade Commission, now Secretary Manager of the National Lumber Manufacturers' Association) points out correct and incorrect methods of handling depreciation and investment, showing that the difference between a cost calculated upon the net-investment method may show a variation of $2 to $3 per thousand feet, as compared with a similar computation based upon the gross investment. This difference may often be the difference between a fair profit and no profit at all.

The two forms of accounts are discussed in detail, good diagrams illustrating each method. The conclusion is that the net-investment method is incorrect in principle and inconsistent with uniformity in cost-keeping methods and intelligent price-fixing policy based upon the costs of production (*American Lumberman,* July 27, 1918).

If Dr. Compton's conclusions are correct, the Forest Service may have occasion to revise the instructions of its "Manual of Stumpage Appraisal."

A more or less uniform cost-accounting system was adopted in September by the California White and Sugar Pine Manufacturers' Association, and is outlined in some detail in the *American Lumberman* of October 5, 1918.

A cost accounting system has also been adopted by the Hardwood Manufacturers' Association of the United States (lately amalgamated with the American Hardwood Manufacturers' Association). Some six forms are used, facsimiles and official explanations being published, in part, by the *American Lumberman* of November 9, 1918, and the *Lumber Trade Journal* of November 15, 1918.

"THE TIMBER-HOLDING FUNCTION"

The Federal Trade Commission, the Treasury Department, and Congress seem to have decided that for revenue and bookkeeping purposes, standing timber should be valued upon cost, plus carrying charges, rather than upon current market value.

Large owners of stumpage protest against this on the ground that such a practice will work great and unfair discrimination. Tax legislation, which will make heavy levies against earnings over fixed limits, must provide for at least fair interest upon invested capital. The difficulty develops over the definition of "invested capital." For instance, if A, 20 years ago, invested $100,000 in stumpage and has since incurred carrying charges of $50,000, his total "invested capital" might be considered to be $150,000. But if A, previous to 1913, sold to B, and the market value of the stumpage had by then increased to $300,000, B would now have an invested capital of $300,000, and would be allowed to retain his interest upon that investment. It is the lumberman's contention that A, who might have sold out, but who did not do so, should be allowed to enter his "invested capital" as the full current value of the stumpage rather than having the difference between his accumulated cost value and the current sale value considered as excess profit and taxed accordingly.

The question seems, very plainly, to be as to the disposition of "unearned increment," and it would appear very possible that the policy and practice finally established would have a prompt bearing upon timber holdings and the development of forestry in this country. This effect might be for better or for worse.

A good brief upon the matter, by Dr. Compton, Secretary of the National Lumber Manufacturers' Association, is to be found in the *American Lumberman* for November 16, 1918, page 28.

In editorial comment, the *American Lumberman* says:

> "There is in this a lesson for the lumber manufacturer which it will do no harm to reiterate. The troubles the manufacturers are now having with the Federal Trade Commission and over the revenue bill are a logical result of the loose accounting methods that many of them have followed in the past. . . . The timber-holding function and the timber-manufacturing function have not been properly distinguished." (Issue of November 11, 1918, page 28.)

General counsel for the National Lumber Manufacturers' Association is quoted as saying:

> "The difficulty appears to consist very largely in regarding a body of timber as a mine instead of as a crop. Congressmen cannot be blamed for falling into

that error, inasmuch as too many lumbermen regard timber investments in that way."

Mr. Boyle, in talking to the West Coast lumbermen in July, is also reported as saying:

"Generally speaking, we deal with a one-crop growth—a national resource. The national has a deep concern in the forests of the land. These forests are rapidly fading. There has been no plan of co-operation looking to the conservation of this national resource as between the Government and private ownership.

"The Forest Service is the scientific branch of the Government that has charge of the timber interests of the nation. This department has done splendid work for the conservation of our forests. The lumber industry, as such, however, has not shown a broad spirit of co-operation with this department. It should be the function of the National Association to develop a plan whereby the best interests of the nation, as well as the industry, should be conserved in so far as this great resource is concerned." (*Lumber Trade Journal*, August 15, 1918.)

Mr. Boyle's statement is directly to the point, and it is greatly to be hoped that the directors of the National Association may be constrained to give his suggestion real and immediate consideration.

In this connection foresters may do well to observe that, with the exception of Kirkland's notable contribution ("Continuous Forest Production," JOURNAL OF FORESTRY, January, 1917), practically no consideration has been given by them to this most important subject.

Too generally foresters have confined their attention to relatively very minor matters of a narrow, technical character, passing by this particular subject on the assumption that Federal or State ownership of forests, rather than private, must be accomplished as the only remedy for an increasingly intolerable situation.

That we may in this case again successfully disregard European precedent, as is promised in the adjustment of our railroad tangle, is an eventuality worth very careful consideration.

Mr. Boyle intimates that the Forest Service may have some plan "looking to the conservation of this (forest) resource, as between the Government and private ownership." If this is the case, the fact has not been well advertised, and if it is not the case, it would seem high time that such a scheme be matured by the Service.

If Mr. Boyle's suggestion is to be taken seriously and the lumbermen of the country are prepared to look the future of their industry in the face, a meeting of representatives of the National Lumber Manufacturers' Association with those from the Society of American Foresters might pave the way for intelligent and sympathetic understanding—mutually and inexcusably wanting in the past.

In the continued absence of such mutual understanding, the contingency anticipated in the editorial comment on page 831 of the November, 1918, JOURNAL OF FORESTRY may well come to pass.

For instance, effort was made at the Arkansas Constitutional Convention last August to include an amendment "aimed frankly at the heavy holdings of the lumber companies." This provided authority for "a graduated tax on all unimproved, uncultivated, and uninclosed land in excess of 2,500 acres."

The proposed tax rate, starting at 1 per cent of assessed value, reaches 3 per cent of assessed value in 1915, and is in addition to the other State taxes. A further item provides that "no corporation shall hereafter acquire either legal or equitable title to any land in Arkansas, except such as may be necessary for site and railroad purposes."

As was to be expected, little attention seems to have been given to this attempt, but the last Louisiana legislature made effective a law by which a license is required for all persons, firms, and corporations "engaged in the business of severing natural products from the soil."

The license fee is payable quarterly and amounts to 2½ cents per thousand feet for pine, 3 cents per thousand feet for oak and ash, 4 cents per thousand feet for cypress, and 2 cents per thousand feet for all other timber, 2 cents a barrel for turpentine also being collected. All timber operators are required to file specific statements as to the location and character of their business. One-fifth of the collections are expendable by the Forestry Division of the Department of Conservation (*Lumber Trade Journal*, September 1, 1918, page 41).

That "strange" legislation looking toward the radical revision of present conditions is rather generally apprehended among the owners of cut-over lands (ten million acres of which are said to be held by members of the Southern Pine Association alone) is shown by the somewhat guarded but widespread comment of the lumber trade journals.

The Secretary of the Georgia Land Owners' Association, for instance, writes rather cryptically:

> "As to the necessity for owners of land to lead off in plans for their occupancy, this is absolutely essential. If not, under our policy of Government they will shortly be taxed away from their owners through single tax or some other taxing scheme. . . . Certain it is that the owners of the land will miss their opportunity to get something for non-productive land now, because . . . it will be taxed away from them anyway" (*Cut-over Lands*, January, 1919, page 16).

Cut-over Lands for December, 1918, page 4, refers again to a dilemma in which large land holders find themselves. It appears to have been

a somewhat general practice for large operators to carry their cut-over lands as nominal assets upon their books, in some cases the land values being charged off completely, the stumpage being considered the sole asset. The Reclamation Service, in working out the "Lane scheme," has been soliciting the listing of cut-over lands having agricultural possibilities, such listing amounting more or less to an option upon the lands. Now, "the war has produced larger sales opportunities for these big acreages, directly or indirectly consequent on the demand for soldier-settlement land; but coincidentally, income and excess-profit taxes present themselves." . . .

Since the Federal tax starts "on a low valuation and climbs toward the confiscation point in a sales transaction of several hundred thousand dollars or more, it is entirely human that there should be more or less hesitation in offering large acreages for sale. . . . The graduated income tax, so effectively employed in foreign parts (Denmark) for breaking up vast estates and company holdings of land, is discussed as the preferred weapon of the would-be land reformers. . . . There can be no doubt as to the seriousness of the outlook in this regard."

PROFITEERING IN LUMBER

The last week in June a report upon profiteering was made to the Senate by the Federal Trade Commission. The report states that "no excessive profits" have been made by lumber producers on the West Coast, "although it is understood that producers of airplane spruce in that region have taken advantage of the allied governments." However, "information in the Commission's possession does indicate unusually and unnecessarily large profits on the part of southern pine producers. Forty-eight southern pine producers, producing 2,615,000,000 feet of lumber in 1917, made an average profit on their investment of 17 per cent." That this is unusually large for the industry is indicated by the fact that the average profit in 1916 was only 5.2 per cent. The range of profit in 1917 was from a small loss to 121 per cent on the net investment. "The margin of profit per thousand feet in 1917 was nearly double that in previous years, being $4.83 as compared with $2.11 in 1916. A fair margin per thousand feet in the past has been recognized as being $3" (*American Lumberman*, July 6, 1918).

A statement by the president of the Southern Pine Association calls the charges of the Federal Trade Commission "unfair and misleading." He states that a recent investigation shows an investment per thousand feet of annual capacity ranging from $10.75 to $144.96, with an average of $60.81. The net average profit per thousand feet given by the

Federal Trade Commission as $4.83, in 1917, then must represent the yield upon the $60.81 of investment—"certainly not a fair return."

That a margin of $3 per thousand feet manufactured is recognized as fair "is rather a dictum than a fact" is alleged, and that "at no time since 1907 has there been a profit in the lumber industry consonant with the investment therein."

J. D. Lacy is quoted as placing "the reasonable cash value of stumpage (southern pine?) in 1917 as between $7 and $8." Had this value been used in calculating the net profits, rather than the figures actually used, profits would have amounted to but 2.73 per cent.

General commodity prices are quoted to show that "the value of lumber, as expressed in money, shows an increase of 39 per cent, but expressed in exchange value, shows a decrease of 43.7 per cent. The conclusion reached is that "there is certainly no justification whatever in the charge that southern pine has been profiteering."

It would seem evident that the nub of the controversy again rests upon the value to be allowed for stumpage, there often being a very considerable difference between the net cost plus carrying charges and the actual current sale value. The governmental authorities seem to incline toward the former appraisal, the lumbermen toward the latter (*American Lumberman*, July 13, 1918).

There is further discussion of the subject by C. S. Keith in the *Lumber Trade Journal* for September 15, 1918.

"MUST THE LUMBER INDUSTRY ALWAYS TRAIL?"

The rapidity with which affairs in the lumber world are changing and the leading part being played by the trade journals is indicated by frequent editorials, as, for instance:

"An honest appraisal of the lumber industry will develop one fact which is far from satisfying. Too much of its progress has come from without, too little from within. . . . Of course, there have been exceptions . . . but aside from some progress in the actual processes of lumber manufacture, lumbermen have little to which they can point with pride as evidence of a progressive business spirit comparable with what is found in some other industries. Were this not so, the refuse burners would have disappeared from most American sawmills a decade or two ago. . . . The lumber industry has ahead of it a problem of national scope that, while not altogether new, is almost generally unknown—the problem of making lumber a more economical building material in the face of rising costs. . . . It is the problem of selling houses rather than lumber by the thousand feet" (*Lumber*, October 28, 1918, page 1).

A RETAIL LUMBER DEALER'S VIEWS

The president of a prominent lumber company of Chicago, addressing brother retailers, classifies their business troubles under three heads:

"First, utter lack of scientific methods in handling our operations, which not only embraces a lack of understanding of the products we merchandise, from an engineering and botanical standpoint, but a further lack of understanding between producers and distributors of lumber; second, the labor situation; and, third, credit. The manufacturers, as a class, have conducted their selling operations with all the dignity of a snake in quest of a frog, and with about the same result. The lack of knowledge upon the part of users of lumber is due largely to dealers themselves. We cannot refer to any other business of equal importance where the merchants do not use every effort to educate the public to the proper uses of their material. Until the United States Government established a Bureau of Forestry, many retail lumbermen did not know whether their material was originally a tree or a vine. Through the meager teachings of technical engineers and experts, the lumber merchant has slowly absorbed a better knowledge of the product he handles" (*American Lumberman,* December 21, 1918, page 1).

New agencies develop and old agencies must learn new ways.

At a recent meeting of the Retail Lumber Dealers of Wisconsin, they were addressed by members of the faculty of the University of Wisconsin, who urged upon them the possibility and desirability of increasing the service rendered by them to their customers.

It was pointed out to the retail dealers, for instance, that most of them handled tile, and they were urged to learn something as to the proper methods of survey and use of drainage systems.

In a similar manner they were told that much of the Wisconsin agricultural territory was in need of lime, and, insomuch as most of them carried lime in stock, they were shown how to make simple tests for soil acidity, with a view to rendering direct assistance to farmers in improving the value of their lands.

LUMBER WHOLESALER'S POINT OF VIEW

A brief by the attorney for the National Wholesale Lumber Distributors presents in excellent form the relation of the wholesaler to the lumber market, legitimate need for and services rendered by him, and presents in detail the status of the wholesaler, his rights, and so forth.

The document makes an interesting supplement to the publications of the Forest Service in connection with its studies of the distribution of southern pine (*Lumber,* July 22, 1918, page 13).

CONTROVERSY OVER GRADING RULES

Until recently there have been five separate hardwood associations; two, the "National" of Chicago and the "Manufacturers'" of Cincinnati, maintained separate sets of grading rules and separate sets of inspectors.

Conflict of interest and obvious duplication of work have led to repeated efforts to get these two organizations together, so as to agree upon one uniform set of hardwood grading rules.

Under the stimulation of the War Industries Board in the fall, a new effort was made to compose the old dispute. This resulted in the amalgamation of the "Manufacturers'" of Cincinnati with the "American" of Memphis and brought the rules fight again into the fore. The new "American" recently decided to adopt its own rules, evidently with a view to attempting the elimination of those of the "National." The situation evidently exhausts the patience even of the trade journal editors, who go so far as to suggest that there might even have been excuse for governmental intervention, especially since it is now established that the difference between the two sets of rules is practically negligible (concerning which see the following item):

MILL-SCALE STUDY IN OAK

D. G. White, of the Madison Laboratory, recently conducted a very detailed study of red and white oak at an Arkansas mill. Among the several utilities of such a study as listed are a basis for accurate cost accounting—a system for improving methods of manufacture to conserve hardwood supplies.

About 300 logs were followed through the mill and stop-watch records were made at the head-saw.

The product was graded, green, by inspectors of the National Hardwood Lumber Association and of the Hardwood Manufacturers' Association of the United States, then stacked for some three months, and again graded by the same inspectors to determine the degree of degrading which had taken place during seasoning. Very elaborate tables make up the bulk of the report. The cost per thousand, as computed in detail, varied between $15.81 and $17.93.

Difference in scale board measure under the grading rules of the two associations averages about 2 per cent, with a "greater profit per hour" under the rules of the Hardwood Manufacturers' Association than under the National Hardwood Lumber Association.

Milling waste was 41.7 for red oak and 29.9 for white oak.

The report is published in the lumber trade journals and not as an official bulletin or circular, presumably in the hope of being made more easily available to those in a position to use it. Field-work seems to have been finished in February, 1916, the report being published in October, 1918.

As a technical performance, the study seems to leave but little to be desired; but one may wonder as to the point of view of a lumberman trying to apply its results to his business. It would be interesting to know the cost of such a study, and a carefully executed inquiry as to the specific uses made of the report might be profitably considered by the laboratory (*American Lumberman,* October 12, 1918).

FOREST RESEARCH AND THE WAR [1]

By Earle H. Clapp

Assistant Forester, U. S. Forest Service

The experience of the past year and a half in forest research has shown that in many respects we were better prepared for war than we knew. We had a background of twenty or more years, during which we developed an organization and made a very considerable progress in the formulation and solution of problems. A staff of experts was developed on such questions concerning our forests as stand, distribution, and quality, on the economic and technical problems of production, and on problems connected with the mechanical, physical, and chemical properties of wood and its conditioning and utilization for a wide range of purposes. A nucleus was formed around which could be built quickly and effectively an organization capable of whatever expansion might be required. Results were being accumulated. To those of us who have been in close touch with the situation, it is still something of a surprise how completely all the data of past years have been used and how often most of them. Where results were not ready and could only become available through weeks and possibly months of investigation, it was possible to turn for advice and immediate assistance to experts whose knowledge and judgment have matured through years of investigations.

A better conception of the requirements of war-time research may be secured by considering briefly the magnitude of the requirements and the diversity of the use of forest products. England's limited forest capital is largely depleted with the four years of war. A large forest area in northern France is devastated or cleared and her annual cut is anticipated for 20 years. Likewise Italy has so reduced her limited forest capital that cutting for at least one decade and probably two must be far below normal. We do not know definitely what has happened in Germany or Austria, but through devastation or exploitation the forests of an enormous area on the eastern front have been wiped out. To aid in supplying the needs of the western front, Canada sent specially organized forces to Britain and France for timber cut-

[1] Delivered before the Society of American Foresters at its annual meeting, at Baltimore, Md., December 28, 1918.

ting, and our own regiment of Forest Engineers when the armistice was signed had reached 20,000 men. On this side of the Atlantic the spruce industry in New England was being rapidly organized by the Navy to utilize for aircraft the entire percentage of the output suitable in size and quality and, further, to increase output to the maximum. The Spruce Production Corps of the Pacific Northwest operated in a region which before the war had only a nominal production with an Army organization alone on July 1 of 20,000 men. Heavy drains were made upon our southern-pine industry for cantonment and ship material, and ship, aircraft, and cantonment requirements taxed Douglas-fir production in the Pacific Northwest. For gunstocks and propeller material we have almost literally taken a census of the black walnut throughout its range. England and France and Italy, as well as the United States, have covered the tropics of America and Africa and the Philippines to secure mahogany for propellers. The supply of cocoanut shells everywhere has been drawn upon.

The demand for wood for such uses as wagons, ties, road-making, housing, and fuel for the armies was to be anticipated. Less expected was the enormous demand for stakes in the wire entanglements in from one to many lines over the entire length of each front, sometimes reaching a depth of several hundred yards and subject to frequent change. Who anticipated the actual consumption for dugout props and for trench lagging, or that timber would be in such demand that it would be mined after shifts in the front? The war brought home something new in the exacting character of airplane requirements as well as surprised us by the volume necessary. The question of boxing and packing became so important with the need for conserving shipping space and securing the most effective results that a special organization was formed in our General Staff, which later was extended into all of the bureaus of the War Department.

The charcoal in gas masks preserved our western front before gas attacks. Wood pulp when fighting ceased was coming rapidly to the fore to supplement the supply of cotton linters in the manufacture of nitrocellulose, and it was wood pulp again which entered into a paper effective against sneeze gases. Hardwood distillation furnishes an important substance for the manufacture of one class of explosives and grain alcohol of another, and the manufacture of grain alcohol from wood waste and from waste sulphite liquor was stimulated through the great need for food of the grains ordinarily consumed. Naval stores, among other things, had a particular field of usefulness in shrapnel-

making. This merely indicates the wide range of the war uses of forest products, and it indicates also why a large and ever larger staff of investigators—foresters, engineers, physicists, and chemists was needed to work on problems of wood.

In practically all phases of wood preparation and utilization there was throughout the war a very urgent demand for accurate knowledge, not that which is obtained by rule of thumb, which of course has its value, but rather that obtained by painstaking investigations. This was true of the simplest uses—for example, the wooden box—of the things we are all likely to take as a matter of course, and far more true of the newer and more exacting requirements such as aircraft and explosives. And with the demand for accurate knowledge came an equally insistent demand for the man who knew scientifically. This made the problem of holding together an organization outside of the military departments, much less of increasing it rapidly, one of extraordinary difficulty.

In peace-time research a problem of today is pretty likely to be one tomorrow, but in war one can be certain of nothing. I am speaking of the industrial application of results rather than fundamental research. The problem of steam bending heavy oak for artillery wheels without great loss is with us today in an acute form, but we are led to understand that in the motorized artillery for the spring drive of 1919 wheels would have been replaced entirely by a steel caterpiller tread. When the gas mask needed only to afford protection against chlorine, our problem may have been one of quantity production of beech charcoal within certain temperature limits. The use of other gases brought in the cocoanut shell and later the shells and pits of other nuts and fruits. Still later the problem became one of supplementing shell and pit charcoal by one made from wood waste distilled under a special process. The solid wing beam of today must be replaced by a laminated structure tomorrow, and the complicated truss fuselage of yesterday becomes today a beautiful and comparatively simple structure stamped from plywood. The live investigative program of war time, even when it deals with forest products, must take into account very rapidly changing conditions.

As to the field covered in Forest Service investigations and results obtained, time permits only the briefest review. Investigations were, of course, wonderfully stimulated. It was necessary to make material increases in the organization. At the time the armistice was signed there were in the Branch of Research something over 500 persons, a large proportion of this force being stationed at the Forest Products

Laboratory. Not all of the activities could properly be classed as research. Our plan was to aid whoever needed help wherever there was opportunity without the formality of request or invitation. Our question was not whether the line of work was fundamental research or industrial research or research of any kind; it was whether and how an investigative organization could render assistance.

First and last, our activities touched or dealt on a large scale with practically every use of wood in modern warfare, aircraft both lighter and heavier than air and for both land and sea, the wooden ship, military vehicles, boxes and crates and containers and packing in general, lumber and structural timber for many uses, gas warfare, both offensive and defensive, explosives, including the production of grain alcohol, acetate of lime, and pulp for nitrocellulose, the products of hardwood distillation for various additional purposes, wooden limbs, fiber board for various requirements, wooden pipe, wooden implement handles, naval stores products, such as rosin for shrapnel, tannin, nose plugs for shells, and pulp products for camouflage. Another list included the essential non-military uses, such as fuel, potash, cars, shuttles, maple sugar, pulp, etc.

Advice and assistance covered timber resources, both foreign and domestic, as to location, quality, means of increasing production, methods of manufacture in wood-using industries, the properties of wood, substitutes, methods of drying, storing, finishing, and preservation, the preparation and review of specifications, inspection, the training of men, various questions of economics relating to the wood-producing and wood-using industries, and finally the field and laboratory investigations necessary as a basis for the data needed.

Co-operative relations were maintained in the War Department with the General Staff, the Bureau of Aircraft Production, Ordnance Department, Quartermaster Department, Surgeon General, Engineer Corps, Panama Canal; in the Navy with the Bureaus of Construction and Repair, Steam Engineering, Yards and Docks, Supplies and Purchase; and in addition with the Shipping Board, Fleet Corporation, Fuel Administration, Advisory Commission of Aëronautics, Director General of Railroads, War Trade Board, War Industries Board, with several of our Allies, and with large numbers of manufacturers of war orders.

A large part of the activities of the organization centered around the production and use of wood in aircraft construction—a highly exacting and comparatively new field of endeavor. The nations whose

ally we became had practically exhausted the stock of seasoned spruce when our own aircraft program was undertaken. It requires from one to two years to air-dry green spruce 3 inches thick. The Forest Service supplied specifications for kiln-drying spruce comparatively early in the war, under which satisfactory material in the thicknesses mentioned can be secured in from 20 to 40 days. It should be remembered that before this time aircraft designers maintained that only air-seasoned material could be accepted. Intensive investigations are now showing that material kiln-dried under proper specifications is equally or even more satisfactory than that secured naturally. This comparative improvement becomes the more important when it is recognized that only a slight advantage in lightness and strength over the best substitutes makes spruce the preferred airplane wood and warranted the organization of a Spruce Production Division. The problem of drying does not end with spruce. No one could predict on what additional species it might be necessary to draw, and work was well advanced on a number of the best substitutes, so that had the war continued at no time would the United States have been embarrassed through lack of knowledge as to satisfactory methods to dry any species which might have been required.

The highly technical character of airplane design required the best of fundamental data on the strength of woods. Before the end of the war-service strength tests of many years past had risen to a total of more than 300,000, covering about 130 species. This data adapted for use in airplane design in a table showing strength values at 15 per cent moisture were adopted by both the Army and the Navy as a basis for the design of all wooden aircraft parts. It served further in the selection of the species most suitable for airplanes and aided in the rejection of unsuitable species. Even with the best of strength data available, the preparation of satisfactory specifications is a difficult task which demands consideration and advice and constant check by specialists on strength properties of wood. Our experts were therefore able to render assistance the value of which cannot be definitely measured by preparing or reviewing practically all of the airplane specifications for lumber and for airplane parts which were adopted by either the Army or the Navy. The data available enabled our laboratory men by recommending density requirements on the one hand to insure the selection of the strongest stock; on the other hand, data on the effect of defects made it possible to admit specified defects in lightly stressed parts and thus practically double the quantity of acceptable stock without sacrificing

anything in safety. On this latter recommendation alone work which involved for its aircraft application the work of one man for not more than two or three months would when measured in terms of a woods force have run into thousands of men, without enumerating railroads and other transportation and manufacturing facilities.

Ordinary inspection of lumber and wood were found to be entirely inadequate to meet the requirements of inspection of airplane woods. The training of a new and special force was necessary. In this the Service assisted through the preparation of a "Handbook for Inspectors" and short training courses in wood inspection. To emphasize the need for careful work, inspectors were finally required by the Bureau of Aircraft Production to make initial flights in the planes for which they were responsible, so that careful work or the absence of it brought its own reward. Plans for the inspection and certification of glues were also developed by the Forest Service and the work directed for the Army.

Very early the question arose as to the possibilities of built-up wing beams to permit the utilization of an increased proportion of the material cut, and the importance of this construction grew as the size of airplanes increased. The solid wing beam in the plane, with a 30 or 40 foot wing spread, is easily possible; but something else must be looked for when the wing spread exceeds 100 or 150 feet as the other extreme. The design and construction of laminated, spliced, and built-up beams and struts is one of practically unlimited possibilities. Present specifications of the Army and Navy for laminated and spliced beams and laminated struts are based on the results so far obtained in the Forest Service. To supplement ordinary methods of inspection, two simple non-injurious methods by actual test have been developed which reduce by half the number of rejections under the standard method.

Frequent trouble with propellers explains the large number of propellers prepared for each plane, a number which reached seven at one time, at least in foreign practice, and which at the conclusion of the war required three or four for American planes. Rejection of propellers through all stages of inspection is large, but beyond this it is stated by a French authority that 80 per cent of the French propellers produced and shipped to the front are rejected by pilots mainly because they are out of balance. This trouble is largely due to unequal absorption and distribution of moisture and requires for its elimination a waterproof coating. Such a coating was developed at Madison for airplane propellers which incorporates a thin aluminum leaf in the finish. This coating was being placed in production by the War Department.

The growing use of plywood in airplane construction carried with it a growing demand for production of waterproof glues in quantity and for the improvement of their quality. Our production facilities in the United States at the beginning of the war were inadequate. We had comparatively few glues, and the formulæ of those which were being produced were not generally available. The work of the Forest Service developed several formulæ which were demonstrated to manufacturers as needed. This work, together with other assistance to the military departments and to the manufacturers, resulted not only in increasing by two or three hundred per cent the quality of the plywood produced, but also resulted in a direct saving to the Government of several million dollars.

For plywood as a material there was at the beginning of the war no technical information on strength: This was secured rapidly until several thousand tests gave the basis for fairly satisfactory plywood design. These tests were the basis of all the present waterproof plywood specifications and of plywood strength factors used in airplane design by both the Army and the Navy. The tests have already resulted in throwing open the field of use to a number of species formerly considered unsuitable, and the supply of plywood was removed as a factor controlling aircraft production, which it might easily have become.

Strength tests of wood as such and of plywood as a material led logically into tests of airplane parts and were leading still further into tests of assemblies of parts, such as wings, fuselages, etc. As an example of what the specialist in the strength properties of wood can do beyond the airplane designer may be cited tests on the wing ribs of the De Haviland "4." Weight for these ribs was reduced by 30 per cent and strength per unit of weight was increased 300 per cent. The wing rib so developed was adopted. Similar designs were developed for six other Army and Navy planes.

The work of the forester was not completed, however, by furnishing material on the properties and conditioning and use of wood in airplanes. To decide upon the best substitutes for spruce it was necessary, in addition to knowing strength and other properties and methods of conditioning, to know the total and available stand and what might be expected in production. Then in a number of cases there was the problem of stimulating production. Our program included, therefore, field studies not only of the eastern spruces, comparable in everything except size with the Sitka spruce of the Northwest, but also other pos-

sible substitutes, such as Port Orford cedar, Douglas fir, eastern white pine, Norway pine, western white pine, yellow poplar, western hemlock, silver, noble, white, and lowland firs, and even sugar pine, cypress, redwood, and western yellow pine. This work was far in advance of the situation as developed at the time the armistice was signed, but the Navy was using intensively the data secured for eastern spruce.

Judged by the extent of the drain upon our forests, the requirements of the wooden shipbuilding program greatly exceeded those of airplane production. Fortunately, so far as supply was concerned, demands centered in regions of our largest timber production. The use of wood in ships is so old that the art of shipbuilding was almost lost and it was practically necessary to create a new industry. The work of the Forest Service consisted here of a rather exhaustive study of the specifications which should be followed in the selection of timber, in the specifications of the preservatives which should be used to prevent its decay, to a slight extent of the selection of substitutes, such as the best species to use for the standard locust treenail, and to a slight extent of timber supply where again locust was the critical point.

The vehicle wood problem centered largely on the investigative side in the successful application of scientific methods of kiln-drying. Excessive demands soon exhausted the supply of air-dried stock and made it necessary to depend on something far more expeditious than air-seasoning of from one to three years. This can be cut to 90 days in the kilns. The use of improper methods resulted in enormous losses ranging from 10 to 100 per cent—losses which involved not only the timber itself, but disrupted the work of large organizations dependent upon the output of the kilns for the production of vehicles. The proper application of scientific methods, on the other hand, in three large plants under close observation resulted in negligible losses. The question of bending, particularly important in the case of heavy stock required for large artillery wheels, has already been touched upon. The work was well under way, but would soon have been made unnecessary for that specific application through a change in the motive power of artillery and hence the design of gun carriages.

Possibly the most important service we were able to render in connection with small arms was to stimulate the production of black walnut for gunstocks. The black-walnut region was covered in the greatest detail in co-operation with other forestry agencies and with such other organizations as the Boy Scouts. New sources of supply were indicated. New producers were located. The processes of manufacturing

at contributing plants were carefully inspected and supervised to insure the proper cut of desired products. Incidentally these activities were of as direct assistance in supplying material for propellers as for gunstocks. While the results cannot be directly measured, it seems certain that the entire output was more than doubled and at the close of the war the supply of material on hand was not a cause for concern. The question of substitution, however, in the course of two or three years more would have been one of first importance. The limited black-walnut stand made the problem of artificial drying one of first importance also. Proper methods had been developed in co-operation with a plant which before this method had been worked out had been unable to make any deliveries of rifles. A number of the concerns using Forest Service drying specifications are turning out gunstocks with losses of less than one per cent not uncommon. One plant adhering to a different schedule lost 60,000 blanks in one run, valued at $1.20 each when green.

A wooden box seems at first thought hardly a subject for investigation. Our laboratory work of past years was, however, of very great value. It became possible to broaden existing specifications. High-grade white pine, for example, or a very limited number of species, was replaced by approximately thirty species classified according to suitability and in standard widths and thicknesses. Nailing and strapping and construction in general were standardized and adapted to the very severe requirements of overseas shipments under extraordinary conditions as to labor shortage, etc. It became possible to use the species near at hand and to use box-making plants everywhere. Boxes were strengthened to the required point by using a few more nails and by strapping. Large sums were saved in initial costs and requirements, and cargo space, a vital factor, was materially reduced in practically every box specification considered. Some of the boxes in which space was saved were shipped by the millions and many others had merely reached the point of approval for quantity production. Redesigns for specific boxes saved, for example, 30 per cent, 43 per cent, 14 per cent, and 33 per cent of the original cargo space. Official reports are to the effect that since July 1 losses upon arrival in France are only 15 per cent of those before July 1, and now compare favorably with domestic shipments. This is in part due to the application of the investigations of the Forest Products Laboratory.

The use of wood pulp to supplement the supply of cotton linters, for which it seemed to be more satisfactory for purely mechanical reasons

than long-fiber cotton, had reached the point of quantity production. For this the results of the Forest Service were in part responsible.

The use of charcoal for gas masks has already been touched upon. It is a matter of gratification to know that at the time of the signing of the armistice a charcoal closely approximating that obtained from cocoanut shells in gas-absorbing qualities had been developed through semi-commercial production which could be manufactured from material then used only as fuel and available in sufficient quantities to have supplied the entire American Army program to the extent of 4,000,000 men. It is equally gratifying that a similar state of development had been reached in the case of a special filter paper in which pulp was one of the constituents, designed to make gas masks effective against the so-called sneeze gases.

It seems probable, judging from results so far secured, that methods of kiln-drying can be developed for willow which will reduce to 60 or 70 days the three to five years now necessary to air-season this stock. A survey of the wooden-limb industry showed that the supply of artificially seasoned willow for artificial limbs would soon have been exhausted if the war had continued.

The tannin problem became important through the shortage of tonnage for imports from ordinary sources. Our domestic supplies could meet demands only through increased production. A field survey by Forest Service men aided materially through pointing out means in specific cases. Additional work now under way promises the development of a satisfactory method for the artificial drying of pulverized bark, with the consequent saving of large amounts of material which now go to waste.

To turn to wood as a fuel and thus relieve the coal shortage was natural for the forester, and although its amount cannot be directly measured, the joint campaign of State organizations, the Fuel Administration, and the Forest Service unquestionably increased production of fuel wood and thus relieved part of the discomfort and suffering which would otherwise have resulted from the war.

To make sure that our supplies of woods should not be dangerously reduced before this should be anticipated and necessary provision made led to a survey of the timber resources of the United States, which gathered together in tentative form the best available information from all sources. This plan incorporated, also, the idea of securing and maintaining throughout the war the best possible figures on requirements. These and other considerations, such as those which

centered around "The Inquiry," resulted in the compilation of material on the forest resources of all other countries.

The work of the Service on various other economic questions, concerning chiefly the production of lumber, was still in its initial stages when the armistice was signed. It had, however, progressed far enough to demonstrate its value not only to our own men, but to the men of other Federal agencies with which we were co-operating.

I have covered in the briefest way some of the activities undertaken and a few of the results secured. Our conception of the responsibility of the Forest Service during the war was that we should attempt to supply any information which might be needed by any other organization on any problem growing out of the supply and use of forest products. It was not possible to build up the organization fast enough to handle much that we clearly realized should be attempted. The solution of one problem ordinarily developed several more, and there is no reason to believe that the same condition would not have held true even if the war had lasted several years longer.

Furthermore, the value of our results is not confined to war uses alone. The extent to which they are applicable under peace conditions is not yet clear, but it is certain that it is very large. Strength data on plywoods as a material has direct application in many industries. The progress in box investigations can be applied at once and directly to all of our problems of export shipments and with some modifications to domestic shipments. The results in the gas-warfare investigations are more or less directly applicable to mining conditions. The stimulus to right methods of artificial drying will certainly not stop with the declaration of peace. Our fundamental data on the properties of woods supplement in an exceedingly desirable way that which we had secured before. The war investigations have been a wonderful stimulus to the force. Our progress during the past year was probably more than equal to five years of ordinary peace-time investigations, this with particular reference to forest products. I believe that our work in the past year and a half has secured for us a better appreciation in foreign countries of American forestry and American foresters and what we can do. In some phases, possibly many, we have found ourselves ahead of our Allies.

It is still too early to interpret all the lessons of the war for forestry and forest research, but some things are obvious. If there is time to grow them, I doubt if another war will find Great Britain practically without forests, and in varying degree the same lesson holds every-

where. The necessity for forests and for forests at home, of independence of foreign supplies, if possible, even assuming that the sea routes can be kept open to secure them and that tonnage will be available for transport, of supplies of species which will answer the needs of war as well as of peace is clearer than ever before, and let us hope that this knowledge is not confined to foresters.

If forest research in the United States lacked justification before the war, it does not now. The background secured by the work of the past 20 years, the force of trained experts on hand, results used over and over again, the possibility of so much additional work during the war itself, have saved to the Government many times over the entire cost of all the work since its initiation, without taking into account results which cannot be so directly measured, such as the saving of time or the ability to do things well instead of poorly, or the possibility of doing them at all. The war alone has proven the wisdom of the work time and time again and has justified in a year and a half all that has been done.

The war has broadened our conception of the investigative field. There are many more things to do now than there were in April, 1917, and there is greater emphasis on many things which we have known should be done. The advisability of being independent, so far as possible, of foreign supplies does not lessen the need of knowing what and where foreign supplies are the world over, the properties and utilization of these woods, and of economic and trade considerations which influence their production and import. Future wars may be as full of surprises as the present one has been, and all such information has sufficient peace use fully to justify acquisition. More and more the supply and production of wood is becoming an international question.

We ought to know much more definitely what our own forest resources are; how much timber is actually being grown and the possibility of production. We need the foundation in economic knowledge for a wide extension in our national policy in forestry and the part that should be played by the Federal Government, the States, municipalities, and private interests. As rapidly as possible the foundation should be extended for technical practice in the growing of forests. I doubt if we can have it ready as soon as it will be needed. Lack of knowledge of materials, rule-of-thumb industrial processes, and ignorance of economic considerations in our forest industries have been made more glaring by the war than ever and call for a greatly expanded endeavor.

The war has emphasized over and over again the need for research

in all lines of human endeavor, and that the lesson is being heeded is shown by great national research developments, such as that now under way in England. The successful nations in after-the-war competition are going to be those which take the research lesson into account. Industries, certainly for their profits, and possibly in some cases almost for their existence, will likewise be dependent upon the investigative efforts which they make for themselves or those which are made for them by other agencies and the results of which they apply. Investigations to determine the properties of materials and the best methods for their manufacture and use are going to have a very decided bearing on the extent to which they hold their place. No industry can count on holding for its product any field which it has formerly occupied. This holds true of wood and the forest and wood-using industries as much as any others. Foresters should help them to appreciate the significance of this situation, if it is not appreciated already.

It is going to be a question of competition all along the line, beginning with the use of the land, then between materials and industries in our own country, and finally a part of the struggle, friendly or otherwise, with other nations. The most effective preparation for peace will go a long way toward the best preparation for war. A very material element in any plan of preparation will be in research, and in this all agencies must have a part.

If the purpose of research is public service, it cannot be accomplished to a maximum by depending upon Government departments or the industries to accept and apply its results. The war has demonstrated this repeatedly, and in this respect has merely served to emphasize what we already knew. It is a part of the job, therefore, of the investigative organization, if it would render the fullest public service, to make a particular effort to put its findings into application. This requires bringing results in effective ways, such as reports and publications, to the attention of those who should be interested in commercial demonstrations which will adapt small-scale closely controlled laboratory methods to large-scale, more closely controlled commercial conditions. Last of all, however, it is a question of human relations. On the part of the investigator, efforts which are necessary for the wide application of results bring with them a truer prospective and better appreciation of the balance of things and a saner point of view regarding past accomplishments and for future effort. For industries and the public, it means reasonably prompt application of results which are worth while rather than indefinite delay.

SOME ASPECTS OF SILVICAL RESEARCH AS AN AFTER-THE-WAR ACTIVITY[1]

By Clyde Leavitt

Chief Forester, Commission of Conservation of Canada

The object of my argument is to urge that provision be made for a very material extension of silvical research work, particularly in the East. I believe that, so far as the United States is concerned, the Forest Service should definitely take the lead in this, on a very much larger scale than has ever before been considered practicable, as a measure of national preparedness for after-the-war conditions, and that there should be a definite program of co-operation and collaboration with State, educational, and private agencies to this end. The collaboration suggested could readily become international, including Canada as well as the United States. The furthering of such an object offers to the Society of American Foresters an opportunity to render a public service of prime magnitude.

The war has brought to all the peoples of the world a keener realization than ever before of the vital importance of the natural resources in national economy. While this importance has been particularly emphasized by war conditions, it exists to an almost equal extent in times of peace. The forest has shared with other natural resources in the intensified public recognition of these facts.

Clapp has pointed out, in *American Forestry* for July, that if justification were ever needed for forest research work the war has amply provided it. This unquestionably is true. Scientific research everywhere has received a tremendous impetus as a result of demands made by the war and in anticipation of economic readjustment after the war. Governments have appointed councils or commissions to encourage or develop scientific and industrial research generally. All lines of industrial research are receiving particular attention. Better methods are to be developed for the wise utilization of natural resources. As Clapp points out, this has already taken place to a remarkable extent in connection with forest utilization, as witness the phenomenal increase in the scope of the Forest Products Laboratory at Madison.

[1] Delivered before the Society of American Foresters at its annual meeting at Baltimore, Md., December 28, 1918.

However, as Clapp also points out in his article, forest investigative work, under the stress of national necessity, has had to be concentrated on the more immediately pressing problems, primarily in connection with determining the properties and uses of certain woods and the location and extent of existing supplies of specific timbers. In other words, as might be expected, the most pressing problems were those involving utilization and exploitation rather than the growing of the crop.

I submit, however, that the time has now arrived when the balance should be redressed by making the expenditures on research in forest production more nearly commensurate with those on the use of the forest after it has been produced. Present methods of cutting on private lands do not, as a rule, leave the forest in a productive state; they are destructive rather than constructive. This is amply evidenced by the progressive decadence of the lumber industry in many regions and by the gradual shifting of operations to the west and to Canada. The migration of pulp and paper industries to Canada is retarded only by the importation of considerable amounts of pulpwood from privately owned lands in the Dominion, the exportation of such timber from Crown (government-owned) lands being prohibited in order to encourage local manufacture.

The planting of denuded areas should, of course, be encouraged to the greatest possible extent. However, any conceivable planting program will still leave enormous areas untouched, and it is of the greatest importance that the necessity for planting be minimized as much as possible by the adoption of cutting methods that will perpetuate the forest instead of destroy it. What is needed is a nullification of Mr. Pinchot's dictum—which he meant to be of more limited application—that forestry is being practiced everywhere except in the woods. To accomplish this object, a large amount of silvical research is required to determine and demonstrate the fundamental facts, and in addition a large amount of co-operative educational and propaganda work among timber owners to secure the gradual adoption of the improved methods to be thus determined and demonstrated.

Cannot this ideal ride in on the high tide of a sentiment, both public and official, favorable as never before toward scientific research to the goal here suggested? Surely, research calculated to increase the productivity of so vital a natural resource as our forests cannot fail to appeal as being both logical and necessary.

The war has brought about a tremendous appreciation in Europe of the vital economic necessity for forestry practice, and it is logical that

the same result should follow on this continent. It is reasonable to suppose that this tendency will be greatly strengthened by the return from overseas of large numbers of foresters and lumbermen, who will have gained an appreciation of what European forestry has accomplished for the belligerent nations for purposes of both war and peace, and this appreciation should prove an important factor in bringing about more adequate support for constructive forest policies on this side of the water.

Action along these lines is particularly needed in the East, since here is the greatest concentration of population and consequently of markets. Further, the eastern forests are most advantageously situated with respect to possible export to European markets. These forests are relatively much nearer depletion than those in the West, and hence in greater need of attention. The rapidly mounting prices of all classes of timber are reflected in greatly increased stumpage values, which means that many things can now be done in the direction of more conservative methods of cutting than were previously considered feasible. This is particularly true as to pulpwood operations, where, on account of large capital investment, permanency of operation is considered highly important. Further, the time element involved in growing the crop is not so long as in the case of an ordinary lumbering operation. As a rule, also, the class of men at the head of the pulp and paper industries are more susceptible to the adoption of improved methods in the woods than is the average lumberman.

Canada is as keenly interested in this whole problem as is the United States, perhaps more so, because her proportion of non-agricultural land is so much higher. The importance to Canada of placing her forests on a permanently productive basis is shown by the fact that the total annual value of her production of primary forest products is around $200,000,000. The exports of pulp and paper are now around $60,000,000 and are increasing rapidly. One-fourth of the newsprint used in the United States comes from Canada; this constitutes three-fourths of the Canadian newsprint production. The value of an export trade of such magnitude in the economic life of a country can scarcely be overemphasized. The prospects for ultimate improvement in cutting methods in Canada are greatly enhanced by the fact that the great bulk of the non-agricultural lands are in government ownership, and the respective governments have full control over the method of cutting on such lands. Up to the present the forests have largely been handled as sources of raw material rather than as crops, notwithstanding the

general prevalence of diameter-limit restrictions in the regulations governing operations on government-owned lands There is, however, a strong tendency for the administration of the timber business to be placed in the hands of technical forest organizations and the outlook for the future is distinctly encouraging. At the same time there is a great lack of sufficient data on which to base improved cutting regulations, and this inevitably makes for slow progress toward more intelligent methods of cutting.

Recognizing these facts, the Commission of Conservation of Canada has during several seasons conducted silvical investigations, under the immediate supervision of Dr. C. D. Howe, of the Faculty of Forestry at Toronto University. Studies of natural regeneration, with special reference to the effects of repeated fires, have been carried on in Ontario and British Columbia. During the past two years broader investigations have been conducted in the pulpwood forests of Quebec, in co-operation with the Laurentide and Riordon companies, which have shared the expense of this work. We have collaborated also with the provincial forest services of both Quebec and New Brunswick, which have conducted investigations of their own on a smaller scale. The Dominion Forestry Branch has also during the past two years conducted forest investigative work on the Petawawa Military Reservation, Ontario. These activities show that the Dominion and provincial governments of Canada regard silvical investigation as sufficiently important to justify at least some attention during time of war, when a very high percentage of the forestry profession are on military duty overseas. It is to be anticipated that all these activities will be materially increased with the conclusion of hostilities.

The forest investigative work of the Commission of Conservation includes regeneration studies by strip surveys, the establishment of permanent sample plots, and studies of volume and growth. The general object is to determine just what is taking place, and why, on the cut-over pulpwood lands of eastern Canada, and what it is necessary and at the same time feasible to do to improve the conditions. Our investigations thus far appear to show that the effect of present methods of cutting is to deteriorate the quality of the mixed forests, eliminating first the white and red pine, next the spruce, and more recently the balsam, converting the stand more and more into a hardwood forest, which is relatively valueless, due primarily to difficulties of transportation. Some of the points to be considered in our studies are as follows:

(1) The amount of natural regeneration of the valuable coniferous species.

(2) The causes of the high mortality of these seedlings, which prevents adequate representation of the higher diameter-classes. This will include a study of damage caused by insects, for which the co-operation of the Dominion Entomological Branch has been secured. It is hoped also that arrangements can be made for a similar study of forest fungi, particularly the one responsible for the heart-rot of balsam.

(3) Rate of growth of the reproduction present to determine how long after cutting one may reasonably expect another crop.

(4) The cumulative effects of repeated fires on reproduction. Results thus far secured appear to indicate that under some conditions a single burn of light or moderate intensity may be favorable to the reproduction of at least some coniferous species. Beyond any question, however, repeated fires are increasingly destructive.

(5) This raises the question as how far it is desirable to go in utilizing fire as a useful servant under adequate control. This, of course, ties up with the whole problem of slash disposal, the previous consideration of which in the East has been largely based upon questions of fire protection. We need now to consider much more carefully the silvical aspects, or the question of the effects of controlled burning operations on natural regeneration, as well as a measure of sanitation, in connection with the ravages of insects and fungi. Portable fire-fighting pumps have now been devised which give good promise of solving at least part of the difficulties in controlling slash-burning operations. This point opens up the question of how far it is desirable to go in advocating clean-cutting with slash-burning, as contrasted with the selection system, and what restrictions are necessary by regions and types. Here comes in also the question of the extent to which coniferous reproduction may be due to seeds stored in the soil. Studies of natural regeneration on old burns of known age, as well as on old cuttings, will be highly suggestive in connection with a number of these problems. It is proposed also to conduct slash-burning operations under control in selected localities and observe the establishment of natural regeneration through a period of years.

(6) The lack of utilization of the hardwoods in the mixed forests of the northeast is still the greatest obstacle to good forestry practice. Here are involved the problems of transportation and markets. While these are outside the scope of silvical research, they will amply justify all the attention that can be given them. The use of tractors for log-hauling may help solve the first, and the apparent possibility of using up to 10 per cent of birch as a filler, with spruce and balsam, in the

manufacture of groundwood pulp for newsprint may point the way toward one of the partial solutions of the markets problem. Experiments are being made along these lines in Canada, at least partly as a result of representations made by foresters.

Turning now to the situation in the United States. We are all, of course, aware of the splendid work that is being done by the experiment stations in the West maintained by the Forest Service. Is there not, however, an urgent need for similar work in the East, and is it not logical that such work should be centered in the Forest Service, which has the requisite staff of experts? The existence of National Forests in Eastern States would furnish an excuse for such action were one needed. No such justification should, however, be necessary, in view of the unquestionably national scope of the whole Service. Good precedents for such constructive work by the Forest Service in the East are the preparation of management plans for timber owners, in the earlier days of the Service, and the later establishment of numerous sample plots, since, however, turned over to State or educational agencies.

The Society of American Foresters organized nearly two years ago a Committee on American Forest Research "to assemble in convenient form for comparison and reference data on all forest investigations which are being conducted or are proposed by all agencies in the United States and Canada." The president of the Society, in emphasizing the need for such a committee, pointed out the enormous field for forest research in America and the small part of the field which is now being covered. He referred also to the fact that in many agencies research has not been definitely recognized as an important activity; that at the present time no one agency is in touch with the investigative work of the others, and that there is much less of attempts to correlate this work. The plans for the committee include the publication periodically of statements indicating the scope of investigative projects under way, the correlation of research carried on by all agencies, and the encouragement of research on the part of such agencies as might not be alive to their responsibilities. All this constitutes a splendid program, and it is only to be regretted that war conditions have prevented its execution.

Unquestionably, it is of the greatest importance that this program be carried out in some way. My suggestion, however, goes considerably further than this, since it involves the question of Federal support for the carrying out of the actual investigative work on a greatly increased scale, both independently and in close co-operation with State and educational agencies. I may perhaps need to justify such a suggestion

from an outsider by referring to my former connection with the Forest Service.

It seems to me that the Forest Service should again take vigorous hold of the whole question of permanent sample plots, particularly in the East, and also establish experiment stations at selected points. Further, I think it should be prepared to render financial assistance, where such is necessary, in order to get investigative work under way at the hands of State forest services and forest schools. These agencies are generally short of funds available for such work, and such co-operation as is here suggested should bring valuable results. The existence of a central agency, with traveling inspectors, to standardize methods and correlate results would comprise not the least valuable feature of the organization. All this need not, of course, interfere at all with the conduct of investigative work by agencies which are in a position to go ahead independently. The field is so large that there is plenty of room for all. Neither should it be understood that appreciation is lacking of what work is already under way by the leading forest schools and by some of the State and private agencies. The point to be emphasized is the urgent need for a greatly increased program, with special stress on the practical application of results.

In connection with the experiment station work, or otherwise, the co-operation of sympathetic lumbermen could undoubtedly be secured for the establishment of demonstration areas, on which various modifications of standard methods of exploitation would be tried out and the results observed carefully through a period of years. In Canada, as already noted, some of the pulp and paper companies are so keenly interested that they contribute very substantially toward the cost of investigative work on their lands. Studies might also be made of the results secured from technical plans of forest management which may have been put into effect in past years, and definite conclusions drawn, by regions and types. It goes without saying that the highest grade of technical talent would be required, if the results are to be sound technically and feasible commercially. An essential point is that all available data from past, present, and future studies should be thoroughly digested, discussed fully with practical lumbermen, and the results tested on a demonstration basis on actual operations. A big-scale, broad-gauged handling of the situation is required.

All this implies, of course, a very considerable expenditure by the Federal Government and one not provided for by existing appropriations. Have we not, however, ample precedents for such a policy of

Federal aid and support as is here suggested? In the first place, we have the Weeks law, which provides for a Federal policy of subsidized co-operation with States in forest-fire protection. Secondly, we have the very generous appropriations made for the support of the Forest Products Laboratory at Madison, which concerns itself largely with the uses and properties of wood. The Bureaus of Entomology and Plant Industry are concerning themselves very largely with investigative work on the insect and fungous enemies of trees, both independently and in direct co-operation with State and private agencies. Surely, the production of the forest crop, even on privately owned lands, is no less a national concern than is its utilization or its protection from fire, insects, and fungi. Another precedent is the very large aid which the Federal Government has always extended toward the development and encouragement of better methods of agricultural production. The vast areas of non-agricultural lands are much more in need of attention, if they are to continue to add materially to the national wealth, after the virgin stands of timber are removed. Experience shows that this problem has not received adequate attention in the past, and the conclusion would appear to be fully justified that the situation calls for a generous measure of Federal support for a comprehensive scheme of forest investigative work, both independently and in co-operation with State, educational, and private agencies. A greatly increased program of more or less independent work by such agencies is also extremely desirable.

In any program of forest investigative work for which provision may be made in the United States, I think there is no question but that the Dominion and provincial governments of Canada and the Canadian Society of Forest Engineers will be glad of the opportunity of the fullest possible collaboration. This should prove highly desirable, since the forest problems along the international boundary are substantially the same in both countries.

NEED FOR A UNIFIED FOREST RESEARCH PROGRAM[1]

(Contributions from the School of Forestry, Yale University, No. 6)

By J. W. Toumey

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As early as 1845 Carl Heyer, of Germany, published a paper advocating the formation of an association to exercise control over forest research. The recommendations of Heyer were voiced during the following fifteen years by such prominent European foresters as Baur, Gayer, and Ebermayer, and in 1868 Baur published a paper on the organization of forest research and the methods of conducting experiments. At a meeting of foresters in Vienna, Austria, in the autumn of 1868 arrangements were made for the election of a committee of five prominent foresters interested in research to prepare a scheme of forest research, point out most pressing work, discuss organization, and formulate rules. On this committee were Judeich, Heyer, and Ebermayer, who were among the foremost foresters of their day.

The findings of this committee were that so far as Germany was concerned all the larger States like Prussia, Saxony, and Bavaria should have independent forest research institutes and in the smaller States, as in Baden, it was recommended that forest research be organized and made a part of the work of professors of forestry in the colleges and academies within their respective States. After extended discussion of the findings of the committee, due largely to Danckelmann, forest research was finally organized in Germany as a part of the educational branch in forestry. In general, the president of the forest college or academy in a given State became the president also of the forest research institute, as illustrated by the situation at Eberswalde, in Prussia, and at Tharandt, in Saxony.

It appears that Germany was the first country to organize her forest research and to establish forest research institutes. Later on forest research became organized in connection with educational institutions in other countries. Thus the research station in France was under the president of the school of forestry at Nancy. Research work in England was linked up with the educational work at Coopers Hill and later

[1] Read before the winter meeting of the Association of Eastern Foresters, at New York, N. Y., February 1, 1919.

at Oxford. In Austria the work of the research station at Mariabrunn was less closely united with the great school of forestry in Vienna. In India the forest research institute at Dehra Dun was founded, with the express policy that the dual purpose for which the research institute was established was to give a high-class education in forestry and to conduct forest research. It appears, so far as I am able to determine, that in almost every country except the United States forest research has been organized and developed in connection with forest academies and schools through financial support by the Government.

In Germany it was soon realized that some kind of a research organization for the entire country was necessary to bring about co-operation in research at the different institutes and schools, to continue ideas and plans with changes in research personnel, and to assist in planning research and, possibly influence, through friendly criticism, the direction of research. Unfortunately, in this country we have not as yet recognized the need of such an organization. The German Forest Research Association was created in 1872, four years after the election of the committee of five in Vienna. Although the organization of forest research in most other countries has followed more or less closely the German plan, it must be admitted the work was better supported in Germany than elsewhere and that country has been most productive in results. The usefulness of the German Forest Research Association to that country in the past can scarcely be overemphasized. Up to the outbreak of war in 1914 it met twice each year, and included representatives from all German States.

Although the research work of the European forest research institutes is somewhat different in different countries and even in different States within a single country, as in Germany, I have selected the institute at Eberswalde, with which I am personally familiar, as a representative forest research institute. The research work there is under six branches:

1. Silviculture.
2. Physics and chemistry.
3. Meteorology.
4. Plant physiology.
5. Zoölogy.
6. Mycology.

The men at the head of these branches, in some instances, are appointed for research alone; in other instances they are professors in

the forest academy. Although the work in all branches centers at Eberswalde, numerous sample plots and experimental areas have been established in various parts of Prussia and have been selected with special reference to the research in hand.

It was my fortune to visit nearly all the important forest research stations in Europe shortly before the outbreak of war and, so far as I was able to judge, the branches of research at each were much the same, although at different stations there were vast differences in the emphasis placed on one branch as compared with that at another. Thus at Eberswalde the work in the branch of silviculture was especially prominent, while at Tharandt chemical investigations were prominent and had received international recognition. At the research institute in Bavaria meteorological investigations had long been prominent, particularly in reference to forest influences. Although at Mariabrunn, in Austria, silvicultural investigations under Cieslar had long been prominent, special attention has been given to the investigation of the physical and mechanical properties of wood.

Although in Germany forest research was stimulated and unified through a strong forest research association, in some other countries it was not. Thus in Great Britain forest research has for the most part been conducted independently by professors at Oxford, Cambridge, and Edinburgh. So far as the writer can learn, it has not been organized, but is left to the initiative of the professors of forestry in educational institutions. In India, however, an active forest research institute is in operation, with separate branches, but closely linked with the school of forestry at Dehra Dun.

The following research branches are represented in the institute at Dehra Dun:

1. Silviculture.
2. Forest botany.
3. Forest economy.
4. Forest zoölogy.
5. Forest chemistry.

As the development of forestry in India is more recent than that in Europe, we should expect research to take on a somewhat different aspect due to different economic and social conditions, and so it does. For the same reason we should expect this country to take on a different aspect. In India and in the United States, when the interests of forestry center in the utilization of vast stands of virgin timber, forest

research is chiefly concerned with forest economy or, as we term it, forest products. Although this subject is not dignified as a special branch of forest research in European forest research institutes, it seems to the writer to be of prime importance in any country where forestry is in its earlier stages of development. We find it strongly developed in this country, notably at the United States Forest Research Laboratory at Madison, Wisconsin. In India this branch investigates a wide range of subjects as it does in this country. For instance, it investigates the strength value of woods and variations in strength due to cutting at different seasons. It investigates woods useful for special purposes, such as for paper, boxes, matches, etc. It has investigated the antiseptic treatment of wood for special purposes and the treatment of tea-box shooks to make them immune from insect attack. It investigates new markets for forest products, and on the whole is engaged in the same general kind of research as at the Madison laboratory.

At Eberswalde, Tharandt, and elsewhere in central Europe, forests have long been under management, markets are established, the properties of local forests products are well known, and forest research of the nature noted above receives relatively scant attention.

Silvicultural research, however, has the leading place, that larger yields may be obtained from forests already under management. Both in India and America meteorological and silvical investigations center in forest ecology in order to interpret natural forest growth in terms of site factors. In Europe, however, meteorology has for its object the determination of forest influences or forest reactions. Natural forest growth uninterrupted by man has largely disappeared from Europe. In Europe the work of the forest chemist centers in investigations of atmospheric impurities that affect forest growth and research on forest soil. In India and in this country his work centers in chemical investigations of various woods and other forest products.

If we take into consideration the experience worked out in the old world since 1845, it appears that each country and, in the case of large countries like Germany or the United States, each State or province should conduct its own forest researches. Howard, in discussing forest research in India, says that, "judging from European standards, it would appear that each province should conduct its own forest research and there should be less centralization than there is at present at Dehra Dun." In the writer's opinion, the same criticism can be offered in this country. There should be less centralization than there is at present in the United States Forest Service in Washington.

Forest research in the United States should not be confined, as it largely is at present, to the United States Forest Service, which is primarily an administrative and executive branch of the Government. The National Forest Service cannot and will not locate a forest research station in each State, and past experience has shown that those already in existence are located without reference to forest conditions in the entire country, but with reference to the national forests, which are a small part, and in many respects the least important part, of the forests of the entire country.

In agriculture, engineering, mining, and other applied sciences, research is everywhere associated with educational institutions. American schools of forestry must take a larger part in research and the work that they are now doing given a larger hearing.

Although the volume and diversity of forest research in this country, under the United States Forest Service, outshadows that of all other agencies, it should not be overlooked that a good deal of important research work is being done by State agencies, as in Pennsylvania, and by educational institutions working alone and in co-operation with the United States Forest Service.

What we want in this country at once is an organization to co-ordinate and give direction to forest research now being carried on by the United States Forest Service, State agencies, private agencies, and by educational institutions. This central body might be called the American Forest Research Association, comparable in many respects to the German Forest Research Association. A research committee appointed by the Society of American Foresters will not do, as shown in the inaction of the committee appointed some two years ago. It must be a virile association, composed of research workers in the national service, in State service, and in educational institutions, who accept the duties of the association as a part of their daily work.

In Germany the association discusses the various experiments by all agencies in each German State and the exact procedure and method is passed on before the experiment is started. Prior to the outbreak of war the association usually met twice each year. The distances in this country are so great the members of a representative association could not meet oftener than once each year. An executive committee of five members could, however, do the current work of the association. The agencies included in the association should provide funds for clerical work and for publication. An annual calendar of forest research, with reviews and citations of all research within the year, should be printed

by the association. The calendar should record the progress of investigations soon to be undertaken. When investigations are postponed or abandoned without completion, reasons should be given and explanations made when mistakes have occurred.

If forest research is to occupy the place that it merits in this country and be participated in by educational institutions and State agencies, as well as the National Government, a National Forest Research Association is essential.

The question naturally arises, Where is the money coming from for forest research by educational institutions? although we admit, following the analogy of other research, it naturally belongs in educational institutions. Forestry in most respects is closely allied with agriculture. Both deal primarily with the production and utilization of crops grown from the soil. Recently in this country a number of well-known foresters have advocated the national support of forest research by State agencies and by educational institutions. The writer believes that forest research in this country must in one sense be decentralized, but in another centralized. He believes that it must become a larger part of the work of State agencies and educational institutions and correspondingly less a part of the work of the United States Forest Service. At the same time all the research for the entire country must be unified through a strong and active research association.

The same situation was experienced in agricultural research a half century ago that is experienced in forest research today. The States and educational institutions could not secure money for research. With the passage of the Hatch bill by Congress, agricultural research came into its own in this country, and States with their educational institutions became the active centers of agricultural research. It is generally admitted that the State agricultural experiment stations, largely supported by the National Government, but under control of the States, have returned to the nation a thousandfold in improved and larger crops for the expense incurred in their establishment and maintenance.

Forestry needs in this country now what agriculture needed a half century ago. Forestry needs a forest research station in every State in the Union, under national support and linked up with an educational institution, preferably with the College of Agriculture or with established forestry departments in other institutions. Germany before the war supported from public funds a forest research institute in each of her more important States and found it well worth her while. A bill should be urged in Congress for an annual appropriation of $15,000

for each State, to be devoted to forest research in the same manner as the funds from the Hatch bill are devoted to agricultural research. If this plan can be carried through, it will put forestry, as well as forest research, on the map in this country. Forestry research would be placed on the same basis as agricultural research.

Everything which strengthens forestry in the States and in the educational institutions strengthens the United States Forest Service. The research branch of the National Forest Service would have nominal oversight over the State forest experiment stations, just as the United States Agricultural Experiment Station has nominal oversight over the State agricultural experiment stations. The calendar, already suggested, might finally give way to a publication on the lines of the Agricultural Experiment Station Record, but less voluminous, to be a clearing-house for forest research throughout the entire country. Every forester and every friend of forestry should work for a second Hatch bill, that forestry and forest research may take the place in this country that its economic importance demands.

It was a wise and far-seeing law that spread the funds of the Hatch bill into every State in the Union, to be used for a specific purpose, with just enough oversight by a national agency to unify agricultural research and hold it together. It would be a great mistake were all the funds needed for forest research administered through the red tape of a national agency. The agricultural experiment station system of this country has demonstrated its usefulness; forest research should adopt its methods.

P. S.—Since the presentation of the above paper in New York, a number of additions and changes have been made in it, due to the discussion following its presentation, later correspondence with many American foresters, and additional information from European sources. The revised paper was read at the recent meeting of the New England Forestry Congress. The additions relate chiefly to more information regarding the organization of forest research in Europe, and the changes relate to modifications in the first plan proposed for unified forest research in this country.

The organization for forest research in Denmark was at first along lines very nearly like those in this country. A section for forest research was established in that country in 1883 as a branch of the office for the management of government forests. This branch was comparable to our branch of forest research in the United States Forest Service. Denmark found that this plan did not produce satisfactory

results. It was given up in 1901 and a department of forest research was organized, with a chief, working in conjunction with a commission, composed of two representatives of national or State forests, two representatives of private forests, and one representative of forest education. The chief, with the commission, meets at least once each year. They determine the plan of work for the coming year, prepare the budget, report on the work of the preceding year, consult technical men, and invite them to set with the commission in handling special problems. The office of the research station is at Copenhagen, where it is closely identified with educational work. The interesting fact in Denmark's organization for forest research is public and private forestry as well as education in forestry are fully recognized.

Less than two years ago Sweden established a school of forestry in conjunction with a forest research station. Thus Sweden recognizes the importance of close relationship between schools of forestry and forest research stations.

From the discussion of a forest research program at the recent meetings in New York and Boston and from recent correspondence received by the writer, there appears to be much difference of opinion in reference to how forest research can be increased and how a unified forest research program can be attained. All foresters admit that we must have more research and that it must be unified and organized.

Some believe that research can be stimulated and an effective program arranged by a forest committee in the National Research Council. The experience of the past two years indicates that whatever the National Research Council is able or willing to do will be slow in starting and without necessary vigor in execution. A research program must, therefore, be put forward by other agencies without waiting longer for the Research Council to act.

It is believed by some foresters that the Research Committee of the Society of American Foresters can stimulate forest research and establish a unified forest research program for the entire country. It has been suggested if a committee on forestry is finally organized in the National Research Council, it should combine or merge its work with that of the Research Committee of the Society of American Foresters. Furthermore, if the Society and Council do not have funds for necessary publication, such as an annual calendar or volume of research accomplished, research under way, and research projected, its publication might be undertaken by the United States Forest Service.

In order to increase forest research, an effort is now under way to secure support for an annual congressional appropriation of $100,000,

or possibly $200,000, for forest research, under the direction of the Secretary of Agriculture. It has been proposed that this fund be distributed to such State agricultural experiment stations as equip themselves for serious forest research. In my judgment, a law that grants annually a definite sum to each State for forest research is superior to the above.

In order to unify forest research throughout this country and Canada, I still believe a *Forest Research* (Association) *Institute* should be organized. All forest organizations throughout this country and Canada should be members of this institute and pay annual dues sufficient to conduct the work of the institute and sustain the publication of an annual calendar. Delegates chosen by the various forest organizations would be the members of the institute. A strong executive committee of the institute would be necessary in order to properly carry on its work.

SOME REFLECTIONS UPON CANADIAN FORESTRY PROBLEMS[1]

By C. D. Howe

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During the past few months I have had occasion to read the briefs and reviews of the European, especially German and Austrian, silvicultural literature as presented from time to time in the various forestry journals, and I have been impressed—amazed, in fact—by the great mass of contradictory evidence in silvicultural practice. A forester in a certain district, with certain aspect, certain soil conditions, and a definite local climate, makes an unqualified success of a certain silvicultural system. He sends an article about it to a forestry journal, or, if he is a man of more than ordinary energy, he writes a book around his practice and presents the system as the long-sought-for, universally applicable restorer and recuperator of his country's depleted and mismanaged forests. A forester in another district with a different set of climatic and soil conditions finds that his experience with the same system has not been as happy as that of his neighbor; perhaps it has been a complete failure; so he writes an article to the forestry journal denouncing that particular silvicultural practice. Others take up the argument pro and con and words flow in torrents. Often the original case is lost sight of and the debate wanders over the whole field of economics and forestry. There seems to be little agreement as to best methods of silvicultural treatment, even of similar stands in similar situations.

I was also impressed by the apparent fact that silviculture is not on a biological basis, even in Germany and Austria, which have given us most, if not all, of our biological theories with regard to the behavior of trees in the forest. There is a great preponderance in literature of opinion evolved from the office chair over that of action derived from field observation and experimentation. Practice is very largely by rule of thumb without a knowledge of the fundamental principles.

Therefore, it seems to me, leaving out of consideration the differ-

[1] A paper read at the Eleventh Annual Meeting of the Canadian Society of Forest Engineers, Montreal, January 29, 1919.

ences in climatic, forest, and economic conditions, that we only waste time in attempting slavishly to apply European experience to our own forests. We must work out our own problems. We cannot borrow methods from any one else, not even from the United States, for our conditions are different. Every forest type, every river valley within a type, presents its own problems; in fact, with species not floated every five miles from the market, presents its own problem of management and silvicultural treatment. Not only this, if we wish to attain continuous production, our methods must have a biological basis; but before we can establish any general principles we must know what actually happens under given conditions. And we do not know that.

As foresters, we are woefully ignorant of the forest. I think we should spend less time and energy in discussing theories and more time in ascertaining facts. We call forestry a science, but there is little justification for that term. There is not a theory or a practice in the profession that is based upon the amount or the kind of evidence that a biologist, chemist, or physicist would demand as the basis of a working principle. In fact, each year evidence is accumulating that may lead us to modify the fundamental basis of present silvicultural practice, namely, the light relation of trees. Already we have to make so many concessions to other factors that the term is a misnomer. Huxley said: "Speculation that outstrips evidence is not only a blunder but a crime." Speculation with insufficient data to support it has been one of the chief deterrents to the practice of forestry as a science.

Again, I say, we need more data. We as foresters stand almost naked in our knowledge of what goes on in the forest, considering the forest as a group of living individuals. We are probably approaching the end of our supply of sawlogs from virgin forests in the East. Our future supply must come from the so-called second growth. Do we know from actual measurement whether there is going to be any second growth of commercial species; if so, at what periods and how much we can cut? There are places where a diameter limit has been more or less vigorously observed for a number of years; do we know by actual measurement what the result has been in terms of the next harvest? Slash disposal has been carried on in various places, but have we taken sufficient interest to find out what really happens by actual measurement of the conditions, although we may have consumed reams of paper in discussing the subject? It is the custom of the lumberman to cull the forest to different degrees according to the density of the stand. He has been doing this now for thirty or forty years, and yet

do we know what effect the opening up of the crown cover in the various degrees from slight disturbance to complete removal has; what effect these disturbances have upon the regeneration and growth of the commercial species, determined by actual measurement of conditions?

There is probably little doubt that at least one-half of our commercial forest area has been burned. Some of it was burned a hundred years ago and not since; some has been burned only once in more recent years. Unfortunately, a great deal has been burned twice and three times or more. One-half of our future supply, on the basis of area, must come from these burned lands; and yet do we know by actual surveys what proportion of these areas can be depended upon for a second crop, at what periods and how much we can cut?

Considerable areas of forest still continue to be burned. Some of the fires occur in the spring, some in midsummer, and others in the fall. By actual investigation of the subject do we know what relationship, if any, exists between the time of year a fire occurs and the amount of regeneration which follows it? Do we know what the relationship of fire intensity is to the killing of the seed buried in the duff, seed upon which the future crop must depend?

I have suggested a few problems which seem to me fundamental. They must be solved before we can formulate any intelligent plans or establish any silviculture systems to insure the continuous productivity of our forests. There are two methods by which these problems may be approached—the one extensive and the other intensive. The extensive is in the nature of a reconnaissance survey. It consists of a relatively rapid tabulation of conditions by means of strip surveys and then by exploration the determination of the extent of such conditions. While this method has its uses, its chief weakness lies in the difficulty of determining the past history of the area investigated with accuracy, and hence generalizations from the data contain so many suppositions and modifications that they lose their force.

By the intensive method I mean the establishment of sample plots and making a record of what happens from the very beginning of the conditions which we wish to investigate or on areas whose history is definitely known. Sample plots should be established within a given forest type on areas which have been severely, moderately, slightly culled by actual logging operations and records made of the consequent regeneration and rate of growth through a series of years. It would probably be necessary to extend them at least twenty years, perhaps longer. Sample plots should be established where slash disposal has

been made. This is important, not only from the standpoint of reproduction, but also from its influence upon insect and fungous diseases. Regeneration and rate of growth after forest fires should be recorded by sample plots where the exact history of the fire is known. Natural regeneration by the strip system, group system, and by the scattered seed-tree system should be tested by actual experimental plots. An essential part of every sample-plot investigation should be growth studies, with predictions of future yields under the given conditions.

You see, I have laid out an extensive program, and I have mentioned only what seem to me the immediate and most obvious things.

Until we have done these things, although performing a very important, necessary, and patriotic work, we cannot claim to be foresters. Business men could do all that we are doing for the forests of Canada today and they would probably do it much better. In fact, many of our best administrative officers, from the head down along the line, have not had a forestry training. The only excuse for employing foresters or for training foresters is that they shall apply scientific knowledge to the making of a forest continuously productive. How many of us could apply such knowledge derived from our own forests? We have been talking about forestry for thirty years and, with the exception of planting operations, there is little or no forestry practiced in Canada today, if we define forestry as a science whose object is to perpetuate on a given area the productiveness of certain commercially valuable trees.

We are wont to put the blame for this state of affairs upon an indifferent public and upon our legislators, especially the politicians. They are undoubtedly contributing factors, but I think we are chiefly to blame ourselves. We think we have solved the problem when we have placed the blame on another's shoulders, and thereby we exhibit the same psychological characteristics as most investigating committees—which I fear is not rating ourselves highly. As a body of foresters we have been too complacent, too self-satisfied. As my gray hairs increase, as my experience with men extends, I meditate more and more upon the peculiarities of that pulpy mass of gray matter which we call the mind. I have concluded that it is good, it is human, to be conservative: but it is always bad and sometimes inhuman to be too conservative. This habit of mind if long continued brings us inevitably to the point where we worship the T-A, T-A. This means *Things As They Are.* We ascribe to *Things* certain qualities and certain powers which they possess only because and as long as we believe

they possess them. We make of these *Things* what, if we were a little lower in the scale of humanity, would be called a fetish. We ascribe to them almost supernatural powers. For example, not so many years ago we were saying: "The Government must not exercise any supervision over railways, telephones, and other public utilities, for it would be interfering with private enterprise, and that would break some economic law. You must not disturb that sacred *Thing,* economic law, or terrible consequences will result." Nowadays that idol is overturned, and we witness the spectacle of a great railway system maneuvering so as to fall into the governmental lap. The fact that the lap was well padded with greenbacks detracts little from my point.

There are several idols to which we as foresters bow down with varying degrees of obeisance according to temperament. One of these is that it is unwise, indiscreet, or undiplomatic to tell the whole truth about our forest conditions. We must not proclaim too loudly that the commercial forest-bearing area of Canada is much more restricted than is generally believed, for it detracts in some unaccountable way from our glory; it savors too much of criticism, and criticism is unpatriotic. Some years ago I gave Dean Fernow's Clay Belt Report to a student to read as part of a course in forest geography. Upon questioning him, I soon discovered he had not read it. He said he didn't care to read anything that criticised his native province. We as foresters have been too much inclined to bow down before this type of mind, as exhibited by the politician and certain portions of the public press, forgetting that forestry is one of the most patriotic of professions, and that the sooner the whole truth is known the more opportunity we shall have to exemplify our patriotism.

Also we must not proclaim too loudly that lumbering methods are depleting large areas of our forests of commercial species beyond any hope of repair without planting. It would disturb business. Would such knowledge disturb any legitimate business transaction? Would such knowledge disturb any present business more than the continuance of the practice will disturb future business?

As a profession, we acknowledge that slash disposal is necessary or desirable, at least from the standpoint of fire protection, protection from disease, and from the standpoint of regeneration. We acknowledge that it is good and perhaps necessary for the continuity of forest productiveness, and yet we say it cannot be done on licensed lands. We say it is not fair to make the lumberman do it, for it would increase the logging cost. We say it is impracticable to dispose of slash by a sepa-

rate crew paid by the owner of the land—the Government. We reiterate these statements so often that it becomes a mental attitude and in time we bow down before it; we make a fetish of a negative idea. We lose sight of the fact that through whatever agency the work is done the cost is eventually paid by the consumer of the product, who in this case is also the owner of the land—the people. If slash disposal is necessary for the continuous productivity of the forest, the end will justify the cost and the people will pay the price. If we grant the premise, we must grant the conclusion. Unless we can endure being called illogical or supine, if we believe in its necessity, we must insist on its accomplishment. Here, again, I think we have created a *Thing* and ascribed to it powers it does not possess.

Perhaps the ugliest of our idols, the one most frequently thwarting our purposes, the one most often removing us from the possibility of joining the Sacred Name Society—in short, the most heartily detested and at the same time the most abjectly worshiped idol—might be called the great P. P., a patron of age—hoary age—of the politician. We spend the best energies of our lives trying to make our forest services effective, especially that service the most important of all, the protective service, and yet, although we have been striving for thirty years or more, we always just miss getting to our destination, for somewhere astride every trail sits the hideous grinning *Thing*. It has balked us so often that we ascribe to it powers which it really does not possess. We have made a fetish of the idea that it cannot be done away with; that it is a natural growth and so invulnerable. The chances are, however, that this *Thing* is just as afraid of us as we are of it. Some day not very far removed we will topple over that idol and discard the fetish, and I have a feeling that none would be more anxious to help us than the politician himself; I mean the more responsible politician—the legislator and the cabinet minister. When we have gotten rid of the *Thing*, we shall rub our eyes, feel a little foolish and much exasperated that we endured its tyranny so long.

We acknowledge, most of us, deep down in our hearts, that the license system is not a satisfactory system for the disposal of our timber. It is sometimes unfair to the lumberman himself, and most of the time unjust to the owners of the land—the people. Most of us would grant without argument that the direct timber-sales method, with the abolition of dues and ground rents, is more business-like and more just to all parties concerned, and yet because of our mental tendency to worship Things As They Are we are complacent. We who understand

the situation, we who are in the best position to judge, are silent. When we rent a house we expect it to be returned to us by the lessee at the end of the rental period, but when we rent a forest we do not insist upon its return; instead we get a few inferior trees and lots of brush. On much of the burned-over areas not even the soil is returned—no soil, at least, capable of reproducing the forest we have "leased." Suppose you rented a house and discovered that the lessee was taking some of the bricks away; each year an increasing number of bricks. You would realize that the future earning capacity of the house was being gradually lessened and in the end completely ruined. You would, of course, try to prevent the lessee rendering your property practically valueless; but suppose your neighbors said: "Oh, no; you must not do that. That would interfere with your lessee's business." Would you think their argument logical; would you allow them to restrain you from the legitimate protection of your property? It is our business as foresters to produce timber continuously on a given area. We fail in this if we allow our capital stock to diminish with each cutting until it finally reaches the vanishing point. In such case we are not foresters; we are very poor business managers. And, moreover, we are not true to our trust; we discredit our profession if we allow such practices to go on not only without protest, but also without actively working for remedial measures.

It is far from my intention to say anything that even by inference could be considered unappreciative of the untiring, unselfish efforts of a few devoted and noble men in the cause of forestry in this country; but they have been as scouts sent out by the Lord into the promised land. It develops upon us of the younger generation to fight for the possession of that promised land of continuous forest production upon which we believe the continuous prosperity of our country depends. In order to win the fight we must discard certain inhibiting mental attitudes, and by actual measurement and record of the behavior of the forest under various conditions we must lay the foundation for a distinctive Canadian silviculture. It is a big job; it will require courage, persistence, and resolution. But the ultimate success will be worth the cost, and the consciousness that we have done our bit in sustaining the forest industries, thus in maintaining the economic freedom of our country in time of peace as well as in time of war, will be our reward.

PRELIMINARY REPORT OF SOME FOREST EXPERIMENTS IN PENNSYLVANIA[1]

By J. S. Illick

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A few private owners of forest land in Pennsylvania began managing their properties with care and forethought at an early date. The real advent of rational forest management, however, did not take place until after the State became the owner of forest land. In 1897 the legislature authorized the purchase of forest land by the State for the purpose of establishing Forest Reserves, now known as State Forests. Since then each successive legislature has appropriated money for the acquisition of additional forest land. To date (January 1, 1919) 1,032,233 acres have been purchased at a total cost of $2,350,033.97, which represents an average purchasing price of $2.28 per acre.

The following tabulation gives the total forest area owned by the State at the beginning of each year since 1900, and shows how the creation of State forests and the employment of foresters and forest rangers progressed with the acquisition of the land:

Date (January 1)	Total area of State-owned land, acres	Number of State forests	Number of foresters	Number of forest rangers
1900	78,131	0	0	0
1901	95,141	0	1	2
1902	139,537	1	1	6
1903	314,599	1	2	12
1904	402,584	1	2	31
1905	549,565	1	1	26
1906	636,190	1	2	36
1907	701,297	2	8	49
1908	752,492	9	12	56
1909	827,723	15	17	80
1910	916,440	29	33	88
1911	933,115	37	40	90
1912	966,229	39	44	103
1913	982,253	46	54	107
1914	994,029	49	56	90
1915	1,001,227	51	65	89
1916	1,004,866	52	66	84
1917	1,012,180	52	70	77
1918	1,017,773	52	43	81
1919	1,032,233	53	35*a*	91

[1] Delivered before the meeting of the Society of American Foresters, at Baltimore, Md., December 27, 1918.

a One-half of foresters in military service.

The purchasing of forest land, the employment of foresters and forest rangers, and the creation of forests, even if executed in a most satisfactory and business-like manner, should not be regarded as ultimate objectives in forestry, for they are only administrative prerequisites to the real operative procedures, which form the proper basis for judging the degree of success of a forest business.

How to handle a forest property successfully is surely a problem of major magnitude. The *modus operandi* of a forest business, especially during its formative period, should be largely determined by local trials and experiments. Passive acceptance of the opinions and judgments of even the most eminent native or foreign authorities may ultimately hinder rather than help. Idle acquiescence not only deadens creative thought, but may be misleading, in that the particular point of view is based upon remote, often foreign, practice, of which little except the fundamental principles is applicable. Cotta,[2] generally regarded as the most prudent and scientific of the fathers of European forestry, wrote that "things look very differently in the forest from what they do in books. . . . Many entirely one-sided points of view are copied by the merely literary forester so often that they finally stand as articles of faith which nobody dares question, no matter how one-sided or erroneous they may be." It is the writer's belief that we will do well in projecting our forestal procedures on the basis of local experiences, for the more local the experiences are the more specific the resultant prescriptions may be. This point of view is again supported by Cotta, who in 1817 wrote: "What many declare good or bad, proves good or bad only in certain localities." What holds for practically the entire subject of forestry Toumey[3] emphasizes, particularly in the field of seeding and planting. He writes that "although the fundamental principles underlying reforestation by seeding and planting are the same everywhere, local conditions so profoundly affect their application that the forester must work out their manner of use for each locality separately."

Guided by this fundamental and tenable premise and not by a selfish motive, the foresters of Pennsylvania have set up within and about the 53 State forests a large number of experiments, covering a wide range of subjects. Some of these experiments are original in their conception, while many follow beaten paths. A large number are already beginning to show instructive and suggestive results, and I ven-

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[2] Cotta, Heinrich: *Anweisung zum Waldbau*, preface.
[3] Toumey, James W.: Seeding and Planting, page xxxii.

ture to predict that they will be potent factors in shaping the future course of many vital forest practices in the State, and their range of usefulness and applicability may extend to neighboring States.

A better perspective of the field of forest experimentation may probably be obtained by classifying the experiments as follows: (1) Political, (2) managerial, (3) technical.

The *political* or social experiments concern themselves with the human or economic side of forestry. They embrace some of the most interesting and original of all the experiments, and pertain primarily to forestry education, forest legislation, forest recreation, and social service. The *managerial* experiments inquire into the business aspect of forestry and cover such subjects as the organization of the personnel, the size of State forests, the subdivision of forests, the differentiation of stands, methods of disposal of forest products, the development of road systems, and methods of ascertaining the growing stock. The *technical* experiments investigate primarily the problems of forest crop production. The latter outnumber all others, and among them are some of the most essential to present-day forest practice. It would be impossible to treat in a single paper all of the experiments in either of the three classes; hence I have elected to discuss representative experiments in the field of forest production.

No phase of forest production embraces more instructive and essential experiments than that of seeding and planting. To date 1,020 plantations have been established on State forests and 150 have been reinforced. They cover an aggregate area of 19,425 acres and embrace many indigenous and exotic species, which occur in both mixed and pure stands on a large number of different sites.

The principal exotic species planted in the past are European larch, Scotch pine, and Norway spruce. At the end of the spring planting season of 1918 the following number of each had been set out on State forests:

Species	Number of trees planted
European larch	682,142
Scotch pine	2,054,059
Norway spruce	4,547,753

Additional exotic trees have been planted, but on a far less extensive scale than the three foregoing species. Western yellow pine, Douglas fir, western white pine, and Japanese larch have been given a fair and comprehensive trial, having been planted in different parts of the State on a wide range of situations. Some of the other exotic species set out

in relatively small experimental plots, usually comprising several hundred trees, are: Siberian larch (*Larix sibirica*), *Larix kurilensis*, *Larix dahurica*, Chinese arborvitæ (*Thuja orientalis*), Japanese red pine (*Pinus densiflora*), Japanese black pine (*Pinus thunbergii*), Himalayan edible pine (*Pinus gerardiana*), Taurian pine (*Pinus pallasiana*), Himalayan white pine (*Pinus excelsa*), and Colorado blue spruce (*Picea pungens*). Some of these experimental plantings have now been progressing long enough to furnish instructive and reliable preliminary conclusions. The writer will, therefore, set forth some of the conclusions developed from a study of their behavior in the experimental plantations on the State forests of Pennsylvania, and in some instances compare these results with those experienced elsewhere.

Most of the western yellow-pine trees planted to date were set out in 1908 and 1909 on five State forests in different parts of the State. Reports show that the percentage of establishment was low. Of the 1,325 trees set out on the Mont Alto State Forest only 153 remain. A plantation on the Greenwood Forest has about 20 per cent of the original number left. The trees on the Mont Alto State Forest at the end of the 1918 growing season, when the trees were 13 years old, averaged 8.2 feet in height and 1.5 inches in diameter. The maximum growth made by any tree during one season was 25.4 inches. Young pitch-pine trees growing near by exceed it in height growth and almost equal it in diameter growth. Its growth in the four other plantations did not equal that at Mont Alto. A study of the characteristics of this tree in the regions in which it is indigenous and its behavior in the five Pennsylvania experiments revealed no special attributes which would recommend it for further planting in the State.

Douglas fir has been planted more extensively than western yellow pine. The experimental plantings are all relatively young. Both the Rocky Mountain and Pacific Coast varieties have been given a trial. The former grows slowly and the latter suffers severely from frost. This species does well in certain parts of Europe, and it may be possible, through selecting a proper source of the seed supply, to bring it in favor in the East. I have, however, seen only one thrifty middle-aged specimen growing in Pennsylvania. The trees of the Pacific Coast variety, however, have established themselves very satisfactorily, when planted under scrub oak or other hardwood sprout growth, and it may be possible to develop the trees successfully by planting them on areas relatively free from severe frosts and by protecting them with a shelter growth during youth.

None of the conifers native to western North America, which have so far been given a fair trial, furnish any great promise for the future.

European larch has been given a fair trial. It has been planted in all parts of the State under a great variety of conditions. In some respects this species has created a very favorable impression. It grows rapidly, surpassing all other trees planted on the State forests except black locust. In a plantation of 6,000 trees established in an abandoned field with a southern exposure, well-drained sandy loam soil, and an elevation of 900 feet, located on the Mont Alto State Forest, are many trees now 12 years old which have reached a breast-high diameter of 3 inches and a height of 25 to 30 feet, and a few trees exceed 30 feet. This rate of growth represents an average annual height growth of about 2½ feet. It is also adapted to well-drained mountain slopes, which constitute the major part of the State forests, resists storm and extremely low winter temperatures, and produces a very durable wood which will surely find a wide use in the form of poles, posts, and ties. These attributes seem to recommend it for a place in the forests of Pennsylvania.

A study of European statistics, however, causes one to be somewhat skeptical, for it appears to be on the decline. In 1861 it covered 8 per cent of the forest area of the municipal forest of Heidelberg, which was gradually reduced, until in 1909 only 2.3 per cent remained, and in the same year it comprised only about one-half of one per cent of the forest area of Baden. Such reductions certainly imply shortcomings, and a careful study of its habits will soon reveal them.

The individual trees in all the plantations on Pennsylvania State forests show a very irregular height growth. No other tree shows such a wide variation; hence, while some individual trees show an extraordinary growth, stands, as a whole, both pure and mixed, do not appear promising. European experience shows that pure stands are not recommendable and its irregular height growth makes it difficult to mix satisfactorily.

It is a very light-demanding species; consequently not adapted for underplanting and overcoming inferior growth which preoccupies most of the planting sites of the State. It may also suffer considerably from late frosts, which is usually attributed to its starting growth early in spring. This, however, is incorrect. It leafs out early in spring, but does not start to elongate its twigs until about two weeks after most of the common trees have started. An investigation has been in progress at Mont Alto for the past two years to ascertain when the different

trees actually make their growth. During the past season this involved the daily measurement of about 200 trees, and in special cases they were measured twice in a day. The results of this study will be published and will throw much light on the subject of the best time to plant. The ultimate findings will be co-ordinate with an extensive experiment on fall planting now in progress. The foregoing study, amplified with observations on other State forests, proved that European larch leafs out early, but its shoots do not elongate until late; hence, if late frost injury does occur, it takes the form of temporary defoliation and not decapitation of shoots.

Furthermore, European larch is attacked severely by a large number of insects and fungi, suffers heavily from forest fires, demands much growing space, and is generally difficult to handle in the forest. I feel that it can be dispensed with, except that it may be used in stocking areas where snow pressure is liable and for reinforcing openings in stands for which it is well fitted on account of its rapid growth. The latter use implies selecting rapid-growing specimens, which is possible, for I have found that the vigorous specimens in the nursery grow rapidly in the field and the spindly and dwarf nursery specimens, as a rule, continue to lag behind.

Scotch pine has been planted on nearly all of the 53 State forests in Pennsylvania. The first plantations were established in 1909, and since then a large number were set out each year. I venture to predict, however, that in a few years the planting of this species will be relatively negligible. The writer, in an article published in the December, 1917, number of *Forest Leaves*, set forth at length data concerning the planting of this tree in Pennsylvania and the results of some European investigations pertaining to it. In the concluding paragraph I stated that even though Scotch pine is an important timber tree in Europe, there seems to be no special need for planting it extensively in Pennsylvania for forestry purposes, but it may be advisable to continue the planting of it until we understand the sylvical requirements and preferences of the native pines better.

The planting of Scotch pine would no doubt have been continued on an extensive scale, because the juvenile development of all the experimental plantings is satisfactory and in a few cases phenomenal, but through a calamity and a subsequent comprehensive investigation a superior native species was found. Early in the spring of 1918 almost 1,000 mature pitch-pine trees were blown down near Mont Alto. This offered an unusual opportunity to study the species, and special efforts

were put forth to prepare reliable tables of height growth, diameter growth, sectional area growth, merchantable and stem volume growth, form factor, form quotient, and yield. Tables were also prepared showing the actual mill cut in terms of the trees and the component logs. Each table was prepared on the basis of 200 to 600 trees. The complete results will be published soon, and a perusal thereof will show the superiority of the native pitch pine over the foreign Scotch pine.

Just as the Riga district of Russia and the Baltic provinces of Prussia embrace the best stands of Scotch pine, so the Mont Alto, Clearfield, and Snowshoe regions of Pennsylvania contain the best stands of pitch pine in the United States. These regions of optimum development should be the source of the future seed supply for artificial regeneration. Scotch pine grows more rapidly in youth, may attain a greater age and height, and is somewhat more tolerant. On the other hand, Mont Alto pitch pine at the age of 100 years attains a breast-high diameter of 20 inches, as against 14.4 inches for Scotch pine site-quality I, according to Swappach. A comparison of the results also shows that volume growth and form factor of pitch pine surpasses that of Scotch pine site-quality I. In middle age pitch pine exceeds Scotch pine in height growth, but lags behind the latter in youth and does not attain so large a maximum height. These favorable results were obtained from pitch-pine trees which grew up without adequate protection and practically no tendance. It is reasonable to assume that under proper sylvical management this species will do even better.

Heretofore the pitch pine has been underrated. In appearance it is not prepossessing, and its *apparent* annual height growth is very slow, while its actual growth is satisfactory. This is due to the fact that pitch pine usually rests for a while during the growing season and then again resumes growth, and in consequence of this cessation produces a false whorl of branches. Hence, what often appears as the growth of two seasons is in reality that of but one season.

The favor in which pitch pine is now held is not based solely on the above study, but is also in part the result of experimental seeding and planting. Direct seeding in lines and spots has been fairly successful. Broadcast sowing of seed on an experimental plot on the White Deer State Forest after five years showed an establishment of 90 per cent. Planting, however, has been conducted on a more extensive scale than direct seeding. The first pitch-pine trees were set out on State forests in 1911. Since then an increasing number have been planted each year. The banner year was 1918, when 534,000 trees were set out on State-

owned land and 137,250 were supplied for planting on private properties throughout the State. To date, almost one and one-half million pitch-pine trees have been planted on the State-owned forest land of Pennsylvania. The State forest-tree nursery inventories show a total of 350,000 seedlings now in the nursery beds. On the Greenwood State Forest 12.6 acres were planted in April, 1911, with 2-year seedlings. At the age of 10 years the trees average 9.6 feet in height and show an establishment of 83 per cent. This tree promises to be of great forestal importance in Pennsylvania on account of its wide natural distribution, modest and recommendable sylvical characteristics, and satisfactory yield.

Norway spruce has been planted more extensively than any other exotic and with a large measure of success. To date, 4,547,753 trees have been planted on State forests, and 742,260 were supplied for planting on private properties throughout the State. It is the only foreign species which may be regarded as a naturalized member of the forests of the State and it will probably prove a valuable addition. Its principal shortcomings are its extremely slow growth in youth, which causes it to be a rather unsuccessful competitor with the hardwood sprout growth, so common on the planting sites of the State, its susceptibility to insect damage, and its liability to be wind-thrown and injury by late frost.

Insufficient attention has so far been given to the treatment of seeding and planting sites both before regeneration is begun and after the seedlings have established themselves satisfactorily. Extensive areas of forest land in certain parts of Pennsylvania are occupied by an inferior woody growth. That this undesirable growth should be replaced by satisfactory stands of valuable timber trees cannot be questioned, but the proper method of treatment to be used in accomplishing this recommendable conversion has not yet been developed. A number of experiments, however, have been established during the past decade for the purpose of formulating a practical plan of procedure to overcome this undesirable hardwood growth. An outline of a few of the experiments laid out and the lessons learned therefrom follow:

FOREST CONVERSION EXPERIMENT I

An area located on the Mont Alto State Forest and stocked principally with hypermature chestnut and rock oak and a few other species common to the mountain slopes of southern Pennsylvania was lumbered during 1908 and 1909. In the spring of 1910 the lumbered area

and two adjoining small tracts were planted with 8,000 2-year white-pine seedlings. The planted trees established themselves satisfactorily, but thrived for only a few years, because the sprout growth which followed in the wake of the lumbering operation grew rapidly and became very dense in spite of the omnipresent chestnut blight. In 1915 it became quite evident that the plantation could not succeed unless liberated. Plans were immediately prepared which covered not only the liberation of the planted trees, but also a series of experiments which embraced two adjoining small areas in addition to the lumbered tract. One of the adjoining areas was practically free from any existing growth and the other was occupied by a 68-year-old stand of almost pure chestnut, with a .8 density. Both of the adjoining areas were planted at the same time as the lumbered tract and with similar planting stock.

The plans for the experiment called for a division of the aggregate area into the five following plots:

Plot I. Practically no existing tree growth present at the time of the establishment of the plantation, which consequently has been developing unhindered.

Plot II. Occupied by a 68-year-old stand of almost pure chestnut, with a .8 density and no subsequent cutting.

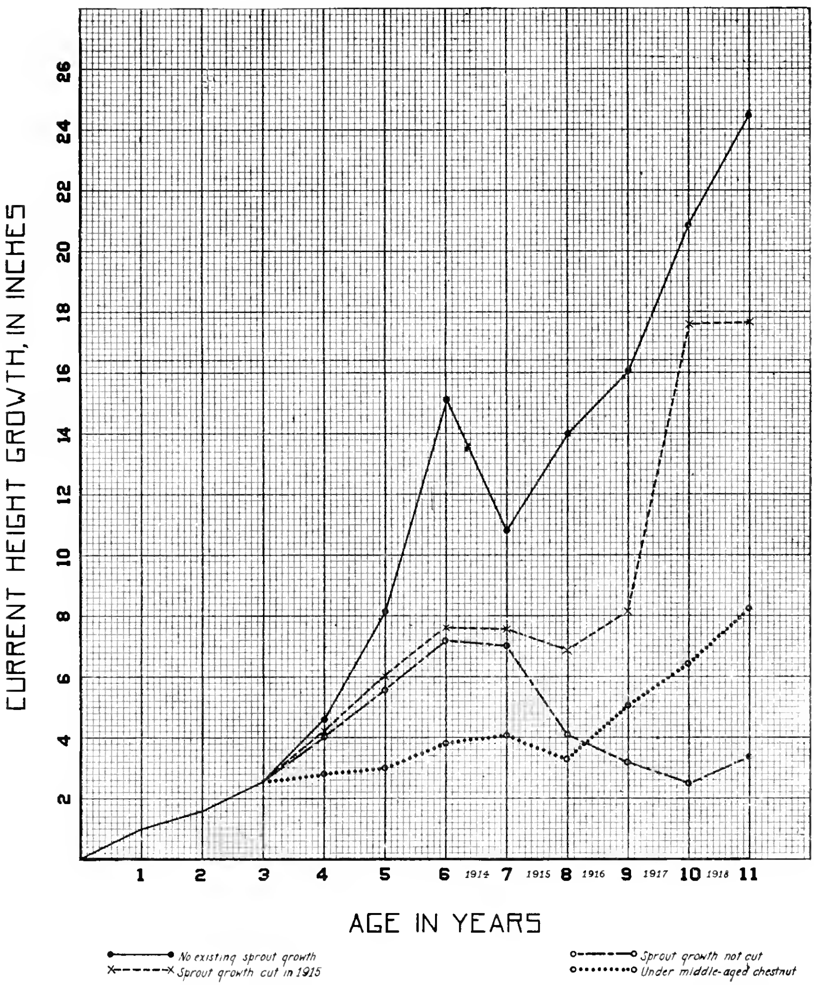
Plot III. Comprises a small part of the lumbered area upon which the resulting sprout growth has not been removed.

Plot IV. Comprises almost half of the lumbered area upon which a complete removal of all the native growth which followed the lumbering operation took place during July and August, 1915—that is, after the season's growth was completed.

Plot V. Comprises about half of the lumbered area upon which an *incomplete* removal of the natural growth which followed the lumbering operation took place during July and August, 1915. A small number of the best sprouts, usually one to three on each stump, were left uncut. The contemplated probable benefits to be derived from such a procedure were:

1. The remaining sprouts would shelter the young white-pine trees.
2. The transition from a dense shade to a partially sheltered condition would be less extreme than in the case of a complete recut.
3. The continuous development of the favored sprouts would retard the origin and development of a second generation of sprouts which always follows.
4. In case of the necessity for a subsequent recut, the favored first generation sprouts might have reached a marketable size, while no returns could be procured from second-generation material.

The results of the experiment are already extremely instructive and will help in projecting a rational course of procedure for future operations. The height growth of the planted white-pine trees on the five plots may be used as an indicator of the degree of suppression pro-



duced by the different conditions of the cover growth. The accompanying chart gives the average current height growth and the average total height of the trees of each plot.

The preliminary results so far attainable from the experiment suggest the following provisional conclusions:

1. Most conifers planted upon clear-cut hardwood areas, particularly where chestnut predominates, will not develop into satisfactory stands unless assisted by removing the interfering sprout growth.

2. The best time to make the first *assistance cutting* is about the third to fifth years after the establishment of the plantation.

3. A plantation is suppressed beyond satisfactory recovery at about the tenth year, if not assisted.

4. A second assistance is usually required and should be carried out about the eighth to twelfth year of the plantation. As a rule, the second assistance cutting need not be so complete as the first. Limiting the cutting to the growth which immediately surrounds the desirable trees may suffice. After the second assistance cutting the plantation will usually be beyond the damaging influence of the surrounding hardwood growth.

5. Incomplete cutting of sprouts—that is, leaving a few dominant sprouts of each stool—is silviculturally and economically recommendable.

FOREST CONVERSION EXPERIMENT II

In the spring of 1912 a companion experimental planting was established on the Caledonia State Forest for the purpose of ascertaining the best method of replacing with valuable timber trees the inferior scrub-oak growth, which occupies extensive areas in certain parts of the State. The area selected was covered with a dense growth of scrub oak, overtopped by a scattered growth of aspen and a few pitch pines and oaks. Three adjoining plots of one acre each were carefully laid out, clearly demarcated, and securely monumented:

Plot I. Was clear-cut of all existing woody growth except a few pitch pine and planted with 2,650 2-year white-pine seedlings. The brush material derived from the clearing operation was removed from the plot and burned. The cost of cutting, removing, and burning the brush was $18.92. The planting cost, excluding the cost of the seedlings, was $10.84.

Plot II. Was only partially cleared of its woody growth and planted with 1,825 2-year white-pine seedlings. Scattered pitch-pine trees 10 inches in diameter and about 50 feet high were left, and a rather evenly distributed growth of aspen 2.5 inches in diameter and 35 feet high was also left uncut. The dense stand of scrub oak beneath the two foregoing stories was completely removed, except an occasional dominant shoot on a stool. These shoots were left primarily to reduce subsequent sprouting. This object was fully accomplished, for in 1918—that is, after a period of seven growing seasons—only a sparse growth of scrub oak is present. The cost of cutting, removing, and burning the brush was $19.89 and the cost of planting $8.31.

Plot III. Received no treatment prior to planting. The 2-year white-pine seedlings, 1,900 in number, were planted beneath the scrub oak, overtopped with a story of aspen, and another of pitch pine and oak. The cost of planting was $9.89.

Seven growing seasons have now passed since the establishment of this experimental planting, and a careful survey of the three plots gives the following results:

1. The height growth of the white-pine trees has been best, and the mortality lowest on the plot from which only a part of the existing growth was removed.

2. The mortality was highest on the clear-cut plot, due to the unsheltered condition during the first year and the subsequent dense shade produced by the low and thick sprout growth which followed the original clearing.

3. Partial cutting of existing growth, if properly done, reduces the origin and development of subsequent sprout growth.

4. Partially cleared plots are the safest from a protective point of view, excepting damage by deer.

5. White-pine trees will not come through on any of the three plots unless assistance is given to them. At the end of the 1918 growing season, when the trees were 9 years old, their average total height on plots I, II, and III, respectively, was only 16.5, 19.8, and 15.9 inches. Open-grown white-pine trees on a similar site at this age would have attained a height of approximately 60 inches.

The foregoing experiment is but one of a large number which have been established throughout the State for the purpose of ascertaining the best and most practical exterminative measures for overcoming scrubby growth, such as scrub oak. In these experiments different species of timber trees were given a trial, the principal ones being white pine, red pine, pitch pine, bull pine, Scotch pine, European larch, Norway spruce, Douglas fir, red oak, and sugar maple.

The study not only embraced a large number of different species of trees, but also covered a wide range of methods of treating the existing growth on the planting sites. These methods may be classified as follows:

A. *Methods of Treatment Before Planting:*

1. Intentional burning over of planting site.
2. Clear-cutting of existing growth, followed by piling or broadcasting of cut material.
3. Clear-cutting and burning of existing growth, followed by:
    a. Grubbing out of stools and roots.
    b. Sculping off of stools.
    c. Covering of stools with ground.
4. Partial—that is, selective—cutting of existing growth.

B. *Methods of Treatment After Planting:*

1. Clear-cutting of hindering growth.
2. Partial—that is, selective—cutting of interfering growth.

In the light of these experimental plantings, post-planting treatment should be emphasized and preparatory or preplanting treatment minimized. Intentional burning of the site preparatory to planting is a

destructive, if not a criminal, procedure. The ultimate loss suffered therefrom more than overbalances the apparent temporary benefit. Furthermore, such a procedure tends to strengthen rather than weaken the already too prevalent popular opinion that forest fires under certain conditions are justifiable. The clear-cutting of existing growth, irrespective of whether or not the resulting material is burned, the stools grubbed out, sculped off, or covered with ground, is too expensive an operation and frequently the resulting growth conditions are still unsatisfactory. Partial—that is, selective—cutting prior to planting is more recommendable than the former methods, but even this is more expensive than necessary. Schlich[4] states that "all outlay on young woods has a serious bearing on the financial result by the time the wood is harvested; hence it should be kept as low as is compatible with efficiency."

The writer wishes to submit the following method of procedure as silviculturally satisfactory and economically recommendable:

1. Minimize and, if possible, avoid preplanting treatment of the planting site.
2. Plant not more than 600 to 1,000 seedlings, preferably 2-year stock, underneath the existing shrubby growth. It is better to use the difference in cost between seedlings and transplants in tending the trees after they are established on the planting site than to spend it in the nursery. Our planting records show that 2-year seedlings establish themselves as satisfactorily as any transplants. They cost less, are transported more cheaply, handled easier in the brush, and planted more readily than the larger transplants, the latter requiring almost equal assistance to get "over the top."
3. About two or three years after the establishment of the plantation *assistance cuttings* should begin.
4. The first assistance cutting may take the form of a partial—that is, selective—cutting. All the sprouts, except one to each stool, should be cut. The uncut sprout will retard subsequent sprouting. The removed sprouts should be cut low, for the planted trees have not yet attained a great height.
5. A second assistance cutting is usually required. This should be less complete and may be at a higher level than the former. In many instances lopping off the interfering branches will suffice. In case the existing growth is unusually vigorous, a third assistance cutting may be required. This, however, is rarely necessary if the first two are properly timed and carefully executed.

The foregoing outline insures a satisfactory establishment and early development of valuable timber trees on areas now occupied by worthless shrubby species, and promises that the accomplishment thereof will not require an excessive expenditure of money. Schlich's[5] supporting point of view justifies being quoted. He writes that "in considering

[4] Schlich, Sir William: Silviculture, 4th edition, p. 293.
[5] Schlich, Sir William: Silviculture, 4th edition, p. 292.

the degree to which noxious plants require to be cleared away, it must be remembered that in moderation they may act beneficially by sheltering the very young trees; hence, interference is not called for until they actually become noxious.

FOREST CONVERSION EXPERIMENT III

The previous experiments concerned themselves with the removal or overcoming of a growth which was not marketable. Experiments have also been conducted in large-sized material. In 1911 a plantation of 34,000 white pine and 8,000 Scotch pine, covering an area of 30.8 acres, was established on the Chatham State Forest, located in Tioga County near the northern boundary of the State. The area at the time of planting was preoccupied by a scattered growth of sweet birch, paper birch, trembling aspen, and large-toothed aspen. This natural advance growth formed an excellent shelter for the young seedlings. Nature supplied a protective cover gratuitously for the young trees, in many respects similar to that which European foresters develop artificially at a considerable expense.

At the end of the 1915 growing season the planted trees had attained a height of 3 to 4 feet. It then became apparent that the shelter growth which heretofore was a benefit to the planted trees was now becoming a hindrance to their development. The reduced height growth and the suffering appearance of the trees convinced Thomas Harbeson, the forester in charge, that they needed immediate assistance. The major question involved, however, was how to furnish this needed help without an excessive expenditure of money, which was neither available nor recommendable to use, if available. The trees comprising the advance growth had now reached a diameter of about 6 inches, and no market existed for the products of the contemplated cutting operation. What, then, was the forester to do? A number of possibilities suggested themselves, but only one of them was feasible enough to be worth following up. This one implied the creation of a market. Following up this lead, the forester made a provisional survey of the wood-using industries of the region, and while thus engaged learned of a farmer who was familiar with the distillation of birch oil, having been engaged in the business during his boyhood days. A conference between the two men, a study of the market for birch oil, and an inspection of the working field resulted in a contract in which the man agreed to remove the sweet birch and pay 50 cents stumpage per still of 216 cubic feet for all material removed. Operations began early in autumn and by

March the job was finished. The forester did not only succeed in having the hindering advance growth removed, but he realized a net return of more than $2 per acre.

This was a commendable accomplishment and in a measure assisted the struggling plantation; but the paper birch, trembling aspen, and large-toothed aspen still remained. During the survey of the wood-using industries the forester learned of six celery farms, located about six miles from the plantation, which used about 30,000 crates annually. An interview with the celery growers was arranged for, with the result that they agreed to use local wood instead of buying it from southern lumber companies, providing it nailed easily, held nails well, and did not warp too badly. A hasty investigation proved that the wood of paper birch and the two aspens gave satisfactory results. A market had been created for the material, but there was still a missing link. The raw material must be prepared for the market. The forester continued his survey and soon found a local sawmill operator who was willing to manufacture the crating material and contract for the advance growth at 25 cents per 2-foot cord stumpage, an equivalent of 50 cents per standard cord. Thus the plantation was not only freed from the interfering advance growth free of any cost, but a net stumpage price of almost $4 per acre was secured for the celery-crate and birch-oil material. This successful experiment is offered as a good and practical example of applied silviculture.

MEASURING CORDWOOD IN SHORT LENGTHS

(Contribution from School of Forestry, Yale University, No. 5)

By R. C. Hawley

Professor of Forestry, Yale University

In connection with the recent wood-fuel campaign the writer had occasion to serve under the United States Fuel Administration in charge of cordwood for the New Haven district. This work brought rather forcibly into view certain features relating to the distribution and sale of cordwood.

It is to be hoped that as a consequence of the high prices and scarcity of coal during the last two years and the spread of knowledge regarding wood fuel that there may be a permanently increased use of cordwood. This is a matter of the greatest importance in making possible a wider and more intensive application of forestry. Anything which will assist in putting the cordwood business on a sounder and more dignified basis should interest foresters.

The appointment of special men to have charge of wood fuel was not initiated in southern New England until 1918. In the New Haven district organized work began late in September of that year. After a rapid survey of the situation, it was evident that several lines of activity were necessary—either to increase the supply of wood available, to facilitate distribution, to increase the use of wood, or to stabilize prices. It is not intended to describe what was accomplished along all these lines. Let it suffice to say that for New Haven the most interesting problem was the control of wood prices. This article treats with certain points developed in dealing with price control.

The United States Fuel Administration had no legal power to fix wood prices. But it was early seen, in Connecticut at least, that under war conditions the force of "moral suasion," as judiciously exercised by representatives of the Fuel Administration and the State Council of Defense, had power, as shown in results secured, comparable to law.

Wood prices in New Haven had risen from $8 per cord, delivered, for hardwood in short lengths, in 1914, to $14 a cord in the first half of 1918, and appeared to be still moving upward. For the purpose of holding prices down to the level then existing, a schedule was drawn

up and issued. This price schedule involved three factors: The price per selling unit, the size (contents) of the selling unit, and the grade of the wood.

Classification into grades offered no difficulties. Prices per selling unit were fixed at about those prevailing at the time the schedule was issued. When it came to specifying the size or contents of the selling unit, wide differences of opinion were encountered.

The cord containing 128 cubic feet was the commonly accepted standard of measurement. No Connecticut law or city ordinance could be found which specified the dimensions of the cord, particularly the length of stick, or even designated it as the unit of measurement for cordwood. So there seemed to be no legal basis for fixing the selling unit. The city sealer of weights and measures contended that 128 cubic feet of piled wood, regardless of length of stick, constituted a cord. He had for years helped settle complaints against wood dealers for short measure on this basis. The fact that he had succeeded in doing so may be due largely to the ignorance of the dealers as to the law and to their unwillingness to go to court.

Notwithstanding this attitude on the part of the sealer of weights and measures, the common business practice of the wood dealers has never been to include 128 cubic feet of piled wood of short lengths in what is sold for a cord.

Instead a cord has been taken by the dealers to mean either (1) a pile of 4 or 5 foot wood 4 feet high and long enough to contain 128 cubic feet (8 feet for 4-foot wood and 6.4 feet for 5-foot wood), or (2) the wood sawed into short lengths which can be secured from 128 cubic feet of 4 or 5 foot wood (obviously when sawed into short lengths and piled this wood will not measure 128 cubic feet), or (3) the wood which thrown in loose will fill a wagon box 4 by 4 by 8 feet.

The wise dealer in selling wood in short lengths under either of the last two systems quotes and bills his customers not for a cord, but for a "box cord" or "loose cord" or "load" of wood. When this is done he cannot be required to give 128 cubic feet or any other fixed amount of piled wood. Only a small percentage of people buying cordwood actually measure the wood received. When a person does measure his wood, uncertainty as to the amount that he should receive often prevents his making a complaint. Consequently the retail wood dealer has been able to conduct his operations about as he pleased.

Probably in 50 per cent of the cases at the lowest estimate dealers deliver to their customers (who think they are buying a cord of wood)

less solid wood than is actually contained in the average cord of 4 or 5 foot wood.

In deciding on the unit to be used as the basis for prices it was advisable either (1) to require that 128 cubic feet of piled wood cut any length be delivered for one cord,[1] or (2) to accept business practice and define the unit (cord) as containing the wood sawed in short lengths which came from a pile of 4 or 5 foot wood containing 128 cubic feet.[2]

Number (2) was taken as the better unit, both because it followed business practice and would therefore cause the least interference with methods of doing business and because it is considered to be the more logical selling unit.

It then became necessary to fix the amount of wood of different lengths which came out of a cord pile of 4 or 5 foot wood.[3]

The wood dealers preferred to have these amounts fixed for wood thrown in loose into a wagon body. This method would make it difficult and often impossible for the purchaser to measure the wood received. If the unit was established as a stated number of cubic feet of piled wood of a given length, the purchaser could easily ascertain whether he had the full amount. For this reason it was decided to express the amount of wood secured from a cord of 5-foot wood in stacked cubic feet.

In tests in Massachusetts the measurement of the amount of wood in short lengths which comes out of a cord of long wood has been expressed in cubic feet of wood thrown loose into a wagon body.[4] This evidently admits of less accurate measurement on the part of the purchaser than a method based on cubic feet of piled wood. Furthermore, from the dealer's standpoint, it should be noted that wood thrown in loose packs together and settles in transit, and when presented for the purchaser's inspection would occupy a smaller space than when first thrown in. Cook admits (see quotation given below) that for 24-inch wood measurement by throwing in loose gave too variable results.

[1] The State of Vermont adopted this system, as is shown in the following quotation from a regulation of the Department of Weights and Measures, State of Vermont, issued September 11, 1918: "A cord shall contain 128 cubic feet of wood; a cord of 16-inch wood shall contain the equivalent of three piles of wood 4 feet high, 8 feet long, and 16 inches wide; a cord of 12-inch wood shall contain the equivalent of four piles of wood 4 feet high, 8 feet long, and 12 inches wide, and no cord of any length wood shall contain less than 128 cubic feet of wood."

[2] A bill is before the Massachusetts State legislature which as now drafted follows this principle.

[3] In the New Haven district both 4 and 5 foot wood are cut, with the latter length as the more customary. For this reason 5-foot wood was used in the tests.

"We soon found that the 2-foot wood piled so irregularly that it would not be possible to establish a standard relation for it."[4]

This being the case, it seems much more logical to employ a system which can be applied with ease and accuracy to any length of wood.

Tests were made, with the assistance of City Forester George Cromie, at two woodyards. A pile of 5-foot wood 4 feet high and 6.4 feet long containing 128 stacked cubic feet of wood was made; the wood was sawed into short lengths, repiled, and the cubic contents of the piles calculated. Two tests, when the wood was sawed into 12-inch lengths, gave 98 cubic feet[5] as the contents of the pile of short wood. This is a shrinkage of 29.5 cubic feet, or 23 per cent of the volume of the original cord. One test where the wood was sawed 20 inches long gave 103.9 cubic feet—a shrinkage of 24.1 cubic feet, or 18.8 per cent. Sufficient time was not available, nor did the situation warrant making a complete set of tests to get averages on each short length.

Finally a figure of 90 cubic feet for short wood 16 inches or under in length and 105 cubic feet for short wood over 16 inches and less than 4 feet in length was adopted. Below the schedule issued is shown.

The wood dealers as a whole considered 90 cubic feet an amount which they should be willing to deliver, but felt that anything over 96 cubic feet was higher than could be secured from the wood. For 12-inch wood, the commonest length sold, 90 cubic feet was thought to be the average output of the long wood handled in the region around New Haven. In the crisis then existing it seemed best to set the amount reasonably low and expect the dealers to live up to it fully. An added argument was that the previous experience of the writer had shown

[4] Measurement of Fuelwood, by H. O. Cook. JOURNAL OF FORESTRY, Vol. XVI, pages 920-921. Information received from Mr. Cook since the publication of his article indicates that he favors expressing the volume of short length wood coming from a cord of long wood in terms both of cubic feet of wood thrown in loose and also in stacked cubic feet of piled wood.

[5] Compare the results of these tests with the figures given in Graves' Forest Mensuration, page 104. Graves' figures as they stand do not give directly the shrinkage in space occupied in sawing long wood into short lengths, but can easily be presented in a slightly different manner to show this relation, as follows:

Shrinkage in Space Occupied by 128 Cubic Feet of Piled 5-foot Wood when it is Sawed into 12-inch Lengths and Repiled

	Straight sticks	Crooked sticks	Knotty sticks
Shrinkage in cubic feet	13.1	21.1	29.3
Shrinkage in per cent	10.2	16.5	22.9

The figures for the knotty sticks almost coincide with the values secured in the tests. However, the wood used in the tests was not particularly knotty nor crooked. Hence it is believed that the figures in Forest Mensuration show too little shrinkage to apply in southern Connecticut.

that less than 90 cubic feet was commonly delivered by dealers as the equivalent of a cord of long wood. If the standard of delivery could be raised to this amount an improvement over existing conditions would ensue. For a permanent standard for future use the amount should be between 95 and 100 cubic feet for 12-inch wood.

MAXIMUM RETAIL PRICES AND SPECIFICATIONS FOR CORDWOOD FOR THE NEW HAVEN DISTRICT

To Apply from October 15, 1918, until Further Notice

Grade.	Long wood, 4 to 5 foot lengths. Per cord containing 128 cubic feet of stacked wood.	Wood over 16 inches and less than 4 feet long. Per load containing 105 cubic feet of stacked wood.	Short wood, 16 inches or under in length. Per load containing 90 cubic feet of stacked wood.
Hardwood .... Principally hardwood, but may contain not over 5 per cent of the chestnut grade.	$11.00	*$12.00 to $14.00	*$12.00 to $14.00
Mixed .... Contains 40 per cent or more of the hardwood grade.	$10.00	*$11.00 to $12.50	*$11.00 to $12.50
Chestnut .... Principally chestnut, but may contain a large percentage of other woods.	$9.00	$11.50	$11.50
Slabs	$8.50	$11.00	$11.00

* Maximum price allowed shall depend on quality. Dealers should have their wood examined and listed as to quality.

This schedule enabled the purchaser of wood to easily check up the dealer and ascertain whether he had the proper measure.

The dealers, of course, could not afford to pile up and get the stacked cubic contents of every lot of wood delivered. For them the easiest procedure was to have a wagon or truck body into which the wood could be thrown loose. This had been their custom in the past. Hence no change in method was required. Most dealers had been in the habit of assuming 128 cubic feet of wood thrown in loose as equivalent to the wood which came out of a cord of 5-foot wood. This is too low. A few tests indicated that 90 cubic feet of 12-inch wood piled, when thrown in loose into a truck body, occupied 140 cubic feet of space, and that 105 cubic feet of 20-inch wood occupied 170 cubic feet of space.

These figures compare closely with those secured in Cook's experi-

ments,[6] where the average for 12-inch wood was 145 cubic feet and for 16-inch wood 160 cubic feet. No experiments were made by him with 20-inch wood.

As a result of the wood-fuel work certain conclusions, which are summarized below, have been formed:

1. A method of measurement for cordwood should be adopted which would enable the purchaser to accurately and quickly determine the measure received.

2. To accomplish this, the unit should be expressed in cubic feet of piled wood of a given length.

3. Such a method of measurement already is in common use for long (4 or 5 foot) wood; a pile containing 128 cubic feet of piled wood constitutes a cord.

4. Following as closely as possible the system used for 5-foot wood in measuring wood in short lengths, either (1) the number of cubic feet of space (128) occupied by the 5-foot wood may be accepted as the unit or (2) the amount of solid wood contained in the pile of 5-foot wood may be taken as the unit, and the space occupied by this solid wood when sawed into various short lengths and piled be determined and taken as the standard number of cubic feet of piled wood, equivalent for that length to one cord of 5-foot wood.

Both methods have an equally sound basis, but the latter is the better, since it follows more closely accepted business practice.

5. The actual amount of piled wood of a given length secured from sawing up a cord of 5-foot wood will vary with the character of the wood; to what extent is not definitely known.

6. Hence the standard amounts should be derived and applied regionally.

7. For southern Connecticut the standard amounts should probably be placed between 95 and 100 cubic feet for 12-inch wood and between 100 and 110 cubic feet for 20-inch wood.

8. Retail wood dealers are not likely to live up to any selling unit until a unit is established which will make it easy for the purchaser to measure accurately cordwood in short lengths.

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[6] Measurement of Fuelwood, by H. O. Cook. Cook's experiments were made with 4-foot wood. As a cord of 5-foot wood contains only about 95 per cent of the solid contents of a cord of 4-foot wood, it is to be expected that a cord of 4-foot wood sawed into short lengths and thrown into a bin loose will occupy more space than a cord of 5-foot wood similarly treated.

REVIEWS

Annual Report of the Department of Conservation and Development of the State of New Jersey for the Year Ending October 31, 1917. Union Hill, N. J. 1918. Pp. 141.

This report deals with a great variety of subjects, the department being a consolidation of a number of State commissions, the State Forester, Mr. Alfred Gaskill, being also Director for the Board of Conservation and Development and transmitting the report to the Governor.

Taking up the section devoted to the report of the State Fire Warden, on 33 pages, with ample tabulations, we find that in the direction of protecting the two million acres (nearly) of forest area success is only very partial. A table recording fires for seven years before a fire service was organized and for eleven years after organization allows ready comparison. Striking is the very considerable increase in number of fires during the latter period, which may, to be sure, be due to more careful reporting. While during the first period (incompletely reported) the number of fires remained considerably below 100, in the last eleven years the average was over 600 and in the last year 871; but the acreage burned over is nearly the same in both cases, around 70,000 acres, in the last year over 92,000 acres. The losses, however, are figured only little less than $80,000, as against $500,000 without protection. A good idea is used in the tabulation by reporting "embryo" fires separately (those burning over less than 5 acres). The cost of extinguishing fires is stated as below $12,000, paid in nearly equal parts by State, townships, and offenders.

The organization of the service consists of 5 State fire wardens, 145 township fire wardens, 186 district fire wardens, 9 patrolmen, and 3 lookouts.

The lookout system seems not yet fully developed. Lack of funds is responsible for this deficiency, some $20,000 being devoted to this fire service, in addition to a $2,000 contribution by the Federal Government, and around $8,000 for the State Forester's office.

Hopeful words are used regarding the improvement in forest conditions and the application of silviculture in proportion to the increase in safety from fire and to the advice given to woodlot owners; but the State Forester, being charged to propose plans for utilizing undevel-

oped lands, is bold enough to say that "New Jersey must have less forest rather than more." He also conceives the seven small State forests, comprising 15,677 acres in all, as experimental grounds, demonstration forest, and outing places; in some cases to accommodate institutions, like colonies for the feeble-minded, who could be employed in forest work.

The Forester is also in charge of shade-tree interests throughout the State, which are maintained through municipal shade-tree commissions, some 89 at present, with resources aggregating around $284,000. For this service the appointment of an "arborist" is asked.

In this connection the status of tree pests is reported. With the chestnut blight "there are some indications that its rate of progress is slowing up." The white-pine blister rust is fully established, but the interest of the State is more strongly taken up with saving the berry hosts than the tree hosts.

The most interesting part of the report, in these times of reconstruction, is that concerning the proposition for the development of undeveloped lands, on which prison labor is to be utilized—a proposition coming from the Governor. It does not find a sympathetic reception by the Commission, and the Forester is to be congratulated on the sane argumentation against the proposition.

"With 400,000 acres of unused (abandoned) farm land, it is apparent that the State's present need is farmers—not farms."

If the 600,000 acres of upland still wooded, although stocked with forest, were made into farms, they would be merely in competition with these abandoned ones.

There are, then, only left to consider 270,000 acres of tide marsh and 110,000 acres of fresh-water swamp, which if drained would yield superior farm land, but would have to carry a charge for drainage of upwards of $200 and, what is most important, would require farmers specially skilled in farming such lands. Incidentally, reference is made to the reclamation by the Dutch of the 520,000 acres of Zuyder Zee at a cost of $363 per acre.

The Forester then gives four pieces of advice as to what the State can do, namely, eradicate the mosquitoes, for which prison labor is very well adapted; advertise State resources; maintain a labor bureau to overcome the present shortage of farm labor; maintain a farm agency to help make farm life and farm management more attractive, with road improvement and educational extension as collateral. An estimate of cost and returns is made: $750,000 for mosquito extermination and $300,000 annually for the other work. An increase in property

values of not less than $900,000,000 is promised as a result of this expenditure and an increase in tax income of 13.5 million.

B. E. F.

Lumber Prices, Report to the Price-Fixing Committee. Price Section, Division of Planning and Statistics, War Industries Board, November, 1918. Pp. 247.

In this report, published in multigraph, average lumber prices for various species in different materials and grades are summarized over the period from the beginning of the year 1913 to about the middle of 1918. The summaries are shown both in tabular form and in charts, giving relative prices on the basis of the average quoted prices for July, 1913, to June, 1914.

Three sources of lumber prices are considered, namely, (1) Trade Papers, (2) Bureau of Labor Statistics and the Federal Trade Commission, and (3) the United States Forest Service. The first are declared to be unreliable, and none of the published quotations are used except from the Commercial Bulletin of Boston, which alone was found to carry lumber-price quotations of a reliable character. The quotations secured from the second source are limited in extent and much of the information originally furnished was disregarded, as it was based on trade-journal reports. The bulk of the report consists of a summary of the information contained in the quarterly bulletins of the Forest Service, which give the average prices f. o. b. mill of a great variety of lumber from mills in all parts of the important lumber-producing sections. These bulletins are based on direct reports from mills of actual lumber prices, and, although there is considerable irregularity noticeable in the material available for these reports from period to period, this has, so far as practicable, been eliminated in the summaries.

In all, seventeen different species are reported upon and prices for various products and grades for each species are given, there being, in the case of southern yellow pine, twenty separate materials dealt with.

The author discusses briefly the major swing of lumber prices between 1873 and 1918, showing the general and rapid upward movement which took place between 1890 and 1907—an increase of 94 per cent, as compared to a 14.6 per cent advance in general prices of all commodities.

The trend of prices since 1907 is best indicated in the following quotation from the report:

"The actual fluctuations in lumber prices since 1907 show the effect of the fundamental factors that have checked advances in lumber prices. It was not

until 1912 that lumber prices had reached the level of 1907, and then, because of the slight business depression in 1914 and 1915, prices again broke sharply. The general upward trend of prices, which began as early as the fall of 1915, did not permanently influence lumber prices until the fall of 1916. The rise in lumber that has taken place since has been greatly stimulated by Government orders and the enforced curtailment of production on account of the labor shortage. In spite of these aids lumber prices have not risen quite so much as the average prices of 'all commodities.'"

W. N. M.

Manual of Tree Diseases. By W. Howard Rankin. The Macmillan Co., New York. 1918. Pp. 398.

This first wholly American work in book form on the diseases of forest trees is one of "The Rural Manuals" edited by Prof. L. H. Bailey, and in conformity with the general plan of this series has been written primarily for the general public. Insect and other animal injuries are not included. The treatment of the subject throughout is simple and direct; the diseases are concisely described and methods of control indicated. The first four chapters deal with such maladies of biotic and abiotic origin as are common to many kinds of trees and are respectively entitled "Seedling Diseases and Injuries," "Leaf Diseases and Injuries," "Body and Branch Diseases and Injuries," "Root Diseases and Injuries." Chapters V to XXXII are devoted to an account of the more "specific diseases," one chapter to each generic host group, beginning with the alders. The arrangement of the chapters is alphabetical, according to the English host group names. Two chapters follow—one on "Tree Surgery," the other on "Spraying and Dusting for Leaf Diseases." The book is equipped with a glossary, a general bibliography of tree diseases, and an excellent index.

This work, though not intended as a text-book, will be welcomed by all students of plant pathology, because it is the only summary available of the diseases of the forest trees of the United States and Canada and because it includes many classified references to the literature. The writing of the book reveals the limitations of forest pathology in America; the number of workers in this field has been small, the subject-matter is as yet largely unexplored, and the applications of the results so far attained have been restricted. The author clearly recognizes these facts and does not fail to point out the direction investigations should follow; in so doing he makes a contribution of prime importance.

J. H. F.

Note on the Preparation of Turpentine, Rosin, and Gum from Boswellia serrata (Roxb.) Gum-oleo-resin. By R. S. Pearson, Forest Economist, and Puran Singh, Chemical Adviser of the Forest Research Institute, Dehra Dun. The Indian Forest Record, Vol. VI, Pt. VI, pp. 303-345, 1918. Superintendent, Government Printing, Calcutta, India. Price, 1s. 2d.

This paper contains the results of field and laboratory investigations for the purpose of determining the best method of obtaining the crude gum-oleo-resin of the Indian tree Boswellia serrata, and also of separating and determining the commercial uses and value of its chief components—gum, rosin, and turpentine. Plans of a plant are added for obtaining these products on a commercial scale. The study also includes a determination of the number of trees available in Indian Government forests for exploitation. The experiments extended over a period of 5 years (1908-1912).

Boswellia serrata is one of some 18 species now known belonging to the family Burseraceæ, a group of plants which is in no way related to the conifers yielding the world's supply of naval-stores products. Most of the species of Boswellia occur in tropical Africa and India. Bursera simaruba, a south Florida tree of the same family, is the only member of this family represented in the United States. Unlike the pine trees, which yield oleo-resin only from the living wood, Boswellia and its family relatives yield gum-oleo-resin only from the living bark. Moreover, the exuding gum-oleo-resin of Boswellia quickly congeals when exposed to the air, while the oleo-resin of pines flows continuously for several months, only at the end of the turpentine season becoming solidified on the scarified "faces" of the trees. The crude gum-oleo-resin of Boswellia has long been known and locally used in India as a frankincense and for medicinal purposes. It is now said to be equal in quality as a substitute for the Arabian and African frankincense.

Boswellia serrata is a medium to large sized deciduous tree, with thin scaly bark, common on the driest and most exposed slopes of hills throughout India, often forming pure, open forests of considerable extent. The 24 different government forest divisions contain 42,694,016 trees suitable for tapping, or an average of 1,777,917 trees to each forest division. In terms of the American turpentine "crops" of turpentine timber (8,000 to 10,000 trees), this number would amount to from 4,269 to 5,336 "crops."

The method of "tapping" finally recommended for Boswellia serrata consists in blazing or shaving off a 6-inch-wide girdle of living bark to

a depth of about one-half the thickness of the bark and at a height from the ground of from 2 to 2½ feet. Within from 4 to 6 days the wound is "freshened" by shaving off a very thin layer of bark from the old blaze down to within an inch of its lower border, and also about one inch in height of new bark on the upper edge of the original wound. The hardened gum is scraped from the wound with a dull knife before each retapping operation, the tappers and scrapers working in pairs. The average yield of gum per tree per year is about 2¼ pounds. In terms of our turpentine "crop" (8,000 to 10,000 trees), the yield would be from 18,000 to 22,500 pounds of gum per season—a far less quantity than our turpentine pines yield. The total yield of turpentine from this crude gum-oleo-resin is estimated at 7 per cent, or about 157 to 197 gallons for 8,000 to 10,000 trees, the remaining yield consisting of nearly equal proportions of resin and gum, which are separable by treatment with solvents.

It is not apparent, except for the greater comfort of the chipper, why the first blazing should not be begun at about 6 inches above the ground, which would afford a much greater length of workable trunk surface and a greater total yield per tree. The tapping is begun in November and terminated within 5 or 6 months—a period which corresponds in length with our pine turpentining season. Trials showed that it is not profitable to tap trees under 30 inches in diameter.

The total number of years Boswellia serrata can be worked is not stated. Tapped continuously, as is the native custom in some forests, probably the period would be about 5 or 6 years. It is recommended, however, that each year's tapping be followed by 2 years' rest, fixing the rotation at 3 years. The effect of tapping on the vitality of the trees, it is said, need cause no serious apprehension. The physical appearance of a trunk after complete working and healing of the wounds presents a conspicuously gnarled and lumpy surface. Whether or not the intention is to rework such trees is not stated. Owing, however, to the exceedingly uneven surface of these trunks, it would seem very difficult, if not entirely impracticable, to again work the trees.

The three commercially valuable constituents of Boswellia gum-oleo-resin are gum, rosin, and turpentine. The gum is obtained by treating the mass with a solvent, while the turpentine is extracted by steam distillation, the residual product being rosin. It is of interest to note in this connection that 89 per cent of the turpentine from Boswellia serrata is distilled at temperatures of from 153° to 160° C., while 85 per cent of American turpentine distils between 155° and 163° C., and 85

to 90 per cent of French turpentine passes over between 155° and 165°.

Commercially considered, a very interesting result of these experiments is the trade estimate made of the quality of turpentine obtained from Boswellia serrata compared with American and European turpentines produced from pine resin. The general statement is made that Boswellia turpentine, consisting mainly of dextro-pinene, is as good as the best American and French turpentines. Submitted to manufacturers of varnishes for practical trial, it was found to dissolve colophony, dammar, sandarac, and soft copal as readily as pine turpentines. The "drying face" of varnishes made with Boswellia and other turpentines were practically identical, but Boswellia varnishes dried more rapidly than others and were uniformly dull, those made with American turpentine remaining bright. As a substitute for the American product it is said that Boswellia turpentine would probably be placed between the French or Spanish and the Swedish or Russian oils.

Boswellia rosin is similar to pine rosin in physical characteristics and, except for soap-making, can be used for the other purposes to which pine rosin is put. Its color corresponds with grade "G" of pine rosins (golden brown), the highest grade of which is nearly as clear as window-glass.

Boswellia gum, in appearance not unlike gum-arabic, was tried as a base in the manufacture of sizing for textiles, etc., but owing to lack of complete solubility in water, due to the presence of resin, it cannot be used for these purposes without special treatment.

G. B. S.

Annual Progress Report upon State Forest Administration in South Australia for the Year 1917-18. By W. Gill. Woods and Forests Department. Adelaide, S. A. 1918. Pp. 13.

This is a well-illustrated report. The forest reserves and plantations of the State comprise around 154,000 acres, 22,300 of which are fenced in for planting and natural regeneration. In spite of a dearth of labor and the difficulty in importing plant material, 582 acres were planted in 1917. The plantations are mainly of *Pinus insignis* for boxboard, and, due to the difficulty of importing softwoods, a good home market for home-grown material developed.

Altogether the financial showing is gratifying, the revenue being $20,000 ahead of the previous year, the total being over $70,000, against $107,000 expenditures. Since the beginning of the forest department in 1876, the expenditures have amounted to over $2,000,000, while the

returns so far amounted to only $1,100,000; but the permanent improvements are estimated at near $600,000.

Over a quarter million trees were distributed free of charge, such distribution having during 36 years disposed of nearly 10 million trees.

B. E. F.

Report on White Pine Blister Rust Control, 1918. Bulletin 2, American Plant Pest Committee. Boston, Mass. 1919. Pp. 16.

In 1915, as a result of a conference of foresters and pathologists, a committee on the suppression of the pine blister rust in North America was formed. This committee was reorganized in 1918 as the American Plant Pest Committee at the fourth annual meeting at Boston in November, 1918. It is a large international committee, composed of four members from each State and Canadian Province, as far as possible consisting of officials having to do with plant pests, namely, commissioners of agriculture, State foresters, State entomologists, and State horticulturists. Its purpose is mainly educational and to secure measures for plant pest control.

The present publication covers very fully the situation of the efforts to control the blister rust of the white pine, and, we may say at the start, takes an entirely optimistic attitude as regards the possibility of its eradication. It takes, also, the position that the responsibility of control must finally rest with the forest owner. This, in our opinion, although the response is reported very satisfactory, is a dangerous conclusion, since one owner's neglect in such cases frustrates the efforts of all others. The committee recognizes this result, however, and, not to lose the momentum gained by State enterprise, urges continuous appropriations for the purpose.

We are specially assured that "*commercial planting of white pine is practicable,* if care is taken to secure uninfected planting stock, and if *all* currants and gooseberries are destroyed in and around the planting area to a distance of not less than 200 yards, and preferably to at least 500 or 600 yards." The removal of all Ribes (cultivated or wild) is declared to be the only practical remedy, and it is found that this can be done cheaply enough in most cases. On the demonstration control areas the costs ran from 17 cents to $19.16 (in swamps), but the average in all types remained mostly below one dollar, running from 25 cents to $2.47 per acre. This with the high war labor cost.

Detail accounts are given for the Northeastern States and Canadian Provinces. Pennsylvania, New Jersey, and farther Southern and Cen-

tral States are practically free from the disease or under control. The same may be said of the Lake States, although isolated infected localities were found. The Western States are still intact.

In Canada the two infected provinces of Quebec and Ontario admit the rust to be ineradicable. There have been three control areas established, however, to determine whether white pine can be grown successfully in areas where the disease is present—to be sure, after eradicating Ribes on the area (1.44 to 9.6 acres per man).

The demonstrated fact that the distance of spread of the disease from the currant is rather less than had been supposed (say, 200 yards) countenances this experiment, but the spread from the pine reaches for miles, as determined by observation in Dr. Spalding's contribution to the bulletin.

Experiments with sprays, reported in the bulletin, give promise of cheapening the process of eradication, fuel oil seemingly being most effective.

Altogether it would appear that the combat against blister rust is not as hopeless as was feared.

B. E. F.

PERIODICAL LITERATURE

BOTANY AND ZOÖLOGY

Root Habits of Trees in Northern Canada

The preponderance of spruce in north-central Canada is usually ascribed to its greater tolerance of low temperatures than that of the predominating trees of the more temperate climates. It is frequently inferred that the *direct* effect of temperature upon physiological processes controls plant distribution in the far north. Howard E. Pulling shows how low temperatures may retard the growth or limit the size of certain arborescent species in an *indirect* way.

The root habits of *Picea mariana, Pinus banksiana, Larix laricina, Betula papyrifera, Populus balsamifera,* and *Pinus strobus* were studied in the province of Manitoba between latitude 55° N. and 56° N. and longitude 96° W. and 98° W. in a uniform clay soil and in a sandy soil, near the south shore of Lake Superior, in Douglas County, Wis. The main characteristics of the root systems are exhibited in dimensioned figures. The soil was found to be generally shallow and frozen at depths ranging from 2 meters on the exposed south slopes to 3 cm. on flat benches, with a northern exposure which acted as a mechanical barrier to root penetration.

These trees were found to differ not only in their root habits, as they do in their top habits, but also in the rigidity with which the habits are maintained under varying environmental conditions. This investigation is summarized as follows:

Root systems may be classified as deep when the habit is centered about a main deeply penetrating tap root and shallow when such a tap root is absent, and the roots remain near the surface of the soil. Various degrees of transition may be recognized, but the important point is that some trees have a very rigid root habit, while with others it is more flexibe. Deep root systems of an inflexible nature cannot produce large trees in shallow soils, whether the shallowness is caused by rock or ice. Trees whose root systems are flexible and are not too deep rooted in deep soil may endure shallow soils. The degree of flexibility of habit and the degree of penetration in deep soils may determine the northward distribution of many plants, regardless of relations between the plant and its environment that may exclude other species from those

regions. Of the species studied, black spruce, tamarack, and birch are classed as having a rigid, shallow root habit; white spruce a flexible, shallow root habit; balsam poplar a deep, flexible root habit; jack pine and white pine a deep, rigid root habit.

C. F. K.

Root Habit and Plant Distribution in the Far North. The Plant World, vol. 21, pp. 223-233, September, 1918.

Life Forms, Leaf Size, and Statistical Methods in Phytogeography

Foresters as well as plant physiologists and ecologists should welcome recent summaries and somewhat abridged English translations of the important works of C. Raunkiaer, which, because of their publication in the Danish language, have received very little attention until recently. He emphasizes the need for greater exactitude and the use of more precise methods in the quantitative study of vegetation in order to place plant geography and ecology on a firmer scientific basis. The same also applies to forestry and especially to forest research.

William G. Smith[1] has reviewed a number of Raunkiaer's papers on his system of correlating the vegetative organs of plants with their environment through "biological types" or "life forms" and their application in phytogeography. Raunkiaer uses the plant itself as the criterion of the biological value of the climate. He selected the adaptation of plants to the critical or most rigorous season as shown by the nature and the degree of protection possessed by the dormant perennial shoot-apices.

The Raunkiaer system distinguishes the following life-forms:

"*Phanerophytes* have their dormant buds on branches which project freely into the air; they are the trees and shrubs. Several modifications of these are recognized: (*a*) According to degree of protection, evergreens, with naked or with

[1] Smith, William G., Raunkiaer's life forms and statistical methods. *Jour. Ecol.*, vol. 1, pp. 16-26, 1913. In review of the following papers by C. Raunkiaer:

"Om biologiske Typer, med Hensyn til Planternes Tilpasning til at overleve ugunstige Aarstider." *Bot. Tidskrift*, 26, 1904.

"Types biologiques pour la géographie botanique." *Bull. Acad. Roy. d. Sci. de Danemark*, 1905, pp. 347-437, 41 figs.

"Planterigets Livsformer og deres Betydning for geografien." Kjobenhaven, 1907, 132 pp., 1 plate, 77 figs.

"Livsformernes Statistik som grundlag for biologisk Plant geografi." *Bot. Tidsskr.* 29, 1908, pp. 42-83, 34 tables. (Translation by *G. Tobler* in *Beih. Bot. Centralbl.* 27, Abt. 2, 1910, pp. 171-206.)

"Livsformen hos Planter paa ny Jord." *Mem. Acad.* Sci. de Danemark, 8, 1909, 70 pp., 29 figs.

"Formationsundersögelse og Formations-ststistik." *Bot.* Tidsskr., 30, 1909, 110 pp., 20 figs.

"Measuring apparatus for statistical investigations of plant formations." *Ibid.*, 33, 1912, pp. 45-48, 1 fig.

covered buds, and deciduous species with covered buds can be distinguished; (*b*) According to size, since this is determined by the relation between the plants and the humidity of the environment: (1) *megaphanerophytes,* with a stature over 30 meters; (2) *mesophanerophytes,* 8 to 30 m.; (3) *microphanerophytes,* 2 to 8 m., and (4) *nanophanerophytes,* less than 2 m. high are distinguished.

"*Chamæphytes* include those plants with their buds or shoot-apices perennating on the surface of the ground or just above it (not exceeding 25 cm.), so that in countries with snow they will be protected in winter, while in other countries with a dry season some protection will be afforded by plant remains. The buds are better protected than in phanerophytes. The chamæphyte types include (1) active chamætypes, with shoots diageotropic and persistent throughout their whole length; (2) passive chamæphytes, with weak stems which lie on the ground; (3) suffruticose chamæphytes in which the perennating parts remain on the surface of the ground after the herbaceous parts have died away on the approach of the critical season; (4) cushion plants.

"*Hemicryptophytes* have their dormant buds in the upper crust of the soil, just below the surface; the aërial parts are herbaceous and die away in the critical period, so that they form an additional protection to the earthbuds. The perennating parts may be long or short, laterally extended or forming compact root-stocks; hence, the group includes a large number of our native woodland and hedgerow species and many rosette or half-rosette species.

"*Cryptophytes* includes plants with their dormant parts subterranean in the case of *geophytes,* with bulbs, rhizomes, tubers on stem, and root and root-buds. Another division is characterized by semi-aquatic dormant buds, *helophytes* and *hydrophytes.* The helophytes, or marsh-plants, do not include all so-called marsh species, but only such cryptophytes as have their buds at the bottom of the water on in the subjacent soil. The hydrophytes have either perennating rhizomes, etc., or winter-buds.

"*Therophytes,* or plants of the favorable season, live through the unfavorable season as seeds; hence, they are annual plants. They are characteristic of deserts and of regions under high cultivation. In temperate regions, two divisions are recognized; (*a*) summer-flowering annuals, (*b*) winter-flowering annuals, which pass through the winter in a vegetative condition."

In the majority of his analyses, Raunkiaer uses the following ten life-forms:

1. *S* = Stem-succulents.
2. *E* = Epiphytes.
3. *MM* = Megaphanerophytes and mesophanerophytes.
4. *M* = Microphanerophytes.
5. *N* = Nanophanerophytes.
6. *Ch* = Chamæphytes.
7. *H* = Hemicryptophytes.
8. *G* = Geophytes.
9. *HH* = Helophytes and hydrophytes.
10. *Th* = Therophytes.

Such analyses are termed biological or phyto-climatic spectra. The basis of comparison is the normal spectrum, which is based on careful studies of from 400 to 1,000 representative species.

With the Northern Hemisphere, Raunkiaer recognizes three principal regional climate-zones:

(A) A tropical area with uniform and high temperatures, but a varying humidity;

(B) To the northward an area of decreasing warmth correlated with an increasing difference between summer and winter, but with a precipitation suitable at most times for plant life;

(C) Warmth decreasing from equator to pole, as in *B*, but with decreasing precipitation, at least in summer.

These climatic zones are characterized by *biochores* or plant-climate boundaries. From this series three types of climate are suggested: (1) phanerophytic, (2) hemicryptophytic, and (3) chamæphytic.

To facilitate the comparison of different climates, Raunkiaer devised "hydrothermic figures," by representing in a single diagram the curve of the monthly averages of temperature and that of the monthly averages of rainfall; then, by determining the biological types or combinations of types corresponding with the hydrothermic figures, he obtained the "biological expressions" of the various climates. These methods are also applicable to altitudinal zones.

Fuller and Bakke[2] have prepared somewhat abridged translations of two of Raunkiaer's subsequent papers. Raunkiaer proposes another quantitative method of much promise in the analysis of vegetation, in so far as this unit is an expression of the biological value of a climate. He considers the size of the leaf as being physiologically important, and, using the simple leaf as a standard, has suggested a system of leaf classes. In his scheme there are six different classes: (1) *leptophyll*, 25 sq. mm.; (2) *nanophyll*, 9 x 25 sq. mm. = 225 sq. mm.; (3) *microphyll*, 9^2 x 25 sq. mm. = 2,025 sq. mm.; (4) *mesophyll*, 9^3 x 25 sq. mm. = 18,225 sq. mm.; (5) *macrophyll*, 9^4 x 25 sq. mm. = 164,025 sq. mm.; (6) *megaphyll*, limited only by the upper limit of macrophylls. In order to facilitate the correct grouping of the leaves, the translators have reproduced the graphic representation of the various limits of surface area of the scheme.

With this method Raunkiaer maintains that the biological factor for climate, in so far as it influences leaf size, may be obtained. Comparisons may be made readily between two climates which have varying

[2] Fuller, George D., and Bakke, A. L.: Raunkiaer's "Life Forms," leaf-size classes and statistical methods. The Plant World, vol. 21, pp. 25-37, 57-63, February and March, 1918. In review of:

Raunkiaer, C.: Om Bladstrrelsens anvendelse i den biologiske Plant geografi. Bot. Tidsk., vol. 33, pp. 225-240, 1916.

Raunkiaer, C.: Om Valensmetoden. Bot. Tids., vol. 34, pp. 304, 311, 1917.

effects. Raunkiaer has shown the utility of such a scheme by analyzing several European evergreen shrub formations. He states that his leaf size classes are not the only quantitative units to be employed, but proves their adaptability to statistical methods.

Raunkiaer's valence method offers a good means of studying a formation by differentiating its species according to their frequency expressed numerically, which serves both as a means of comparing closely related formations and also as a basis for an ecological comparison. The frequency is determined by taking a number of sample plots of a certain size and expressing numerically for each species the percentage of plots on which it occurs. The necessary number of plots is obtained as soon as the result becomes practically unchanged with the addition of more plots. Raunkiaer found that 0.1 sq. mm. was a suitable size, and gave fairly constant results with from 25 to 50 plots.

All who are interested in the details of the methods and unable to read Danish should consult the English papers cited. The latter translation is concluded with the following paragraphs, which speak for the merits and utility of these statistical methods in ecological work with vegetation, including forest investigations:

"The above is a system of formation analysis into primary divisions so fundamental that the biological and physiognomical coincide and are both emphasized. Within its limits there is a place for offshoots, or subdivisions of larger or smaller extent, expressing characters of special biological significance which require special biological (ecological) characterization in the systematic analysis of a narrowly limited formation.

"By more intensive studies of climatic factors, of soil chemistry, of physical and biological conditions, and by a wide investigation of the morphological, anatomical, and physiological nature of plant species, ecology will be able to reach an understanding of the place of each individual species in a formation."

C. F. K.

SOIL, WATER, AND CLIMATE

Redwood Distribution in California

In studying the effect of the precipitation factor in limiting the distribution of the redwood (*Sequoia sempervirens*) in California, William S. Redwoods Cooper secured measurements of precipitation at 22 stations in the Santa Cruz Mountains and in the Santa Clara Valley. Certain areas, not differing materially in topography and soil from adjacent areas supporting luxuriant redwood forests, are practically treeless, except for scattering specimens of *Quercus agrifolia* and *Q. lobata*. He shows that heavy winter rainfall is necessary for the development of the redwood forest. The

author also found that the precipitation itself is effective only when accompanied by abundant summer fog, which greatly reduces transpiration and evaporation. In securing the precipitation records, a type of rain gauge was used in which kerosene was employed to prevent evaporation of the precipitation, making possible the summation of rainfall records covering long periods. C. F. K.

Rainfall and Fog. The Plant World, vol. 20, pp. 179-189, June, 1917.

SILVICULTURE, PROTECTION, AND EXTENSION

Balsam Fir Diseases

Mr. Swaine calls attention to the enormous losses occasioned by a combination of insect and fungus pests in balsam fir in certain sections of Quebec, losses which exceed the losses by fire. "We have a most disheartening example of combined insect and fungus destruction sweeping through the balsam forests of eastern Canada at the present time. Upon hundreds of square miles of forest the balsam has been very seriously injured or killed within the last eight years, and on large areas of this practically all the balsam is already dead."

Eight years ago the spruce budworm began the work on both spruce and balsam, but in three of four years died out. The spruce usually survived the attack, although tops were killed and increment lost. The injury to the balsam was very much more severe, and was followed by two rot fungi, a bark beetle, and a weevil to finish the destruction.

The red rot (*Polyporus schweinitzii*?), common in eastern balsam, has run riot in the budworm-infested trees. "Injured trees die gradually from the bottom of the crown upward, showing here and there dead branches, the foliage generally thin, and the trunk and branches bearing an abundant growth of pale green lichens, or 'moss.'"

The second fungus is a sap rot, which, when its mycelium reaches and surrounds the base of the tree, checks the sap flow, killing the tree rapidly, and is responsible for the red top, as is also the bark beetle, which finds in slash and fire-killed trees a satisfactory breeding ground.

"The second bettle is a snout-beetle, or weevil, which may be called the eastern balsam weevil, one-third of an inch in length and grayish in color. Its eggs are laid in the green or dying bark individually in groups of punctures. The punctures bleed and the balsam drying on the bark in whitish glistening patches betrays the disease. The injury is new to this province. It was found to be spreading rapidly in green timber in some localities this summer and will prove without doubt a serious enemy to the balsam."

As remedial action the author suggests the timely utilization of threatened balsam. "The dying trees, like the fire-killed timber, are attacked by the large boring grubs and the timber entirely riddled, at latest by the end of the second season following the death of the trees; so that prompt utilization is necessary if the dying timber is to be saved. There appears to be only one practical method by which we can hope to accomplish anything definite toward checking the spread of the disease, and that is by *burning the balsam slash. Slash-burning will not only check the injury in and near the diseased areas, but it will greatly improve the conditions for the next crop.* . . . As a preventive and insurance against insect and fungous troubles, the slash should always be burned." Thirdly, cut out absolutely all the balsam of pole size and over, so as to increase relatively the spruce.

The Balsam Injury in Quebec and Its Control. Agricultural Gazette of Canada, March, 1919.

MENSURATION, FINANCE, AND MANAGEMENT

Forests of Alsace-Lorraine under German Management

Huffel describes at length in a rather captious mood the forest conditions of these two provinces and the changes which were made in their conditions during the German occupation. The forest area comprises somewhat over one million acres, or 30.3 per cent of the total area and only .59 acres per capita, requiring, therefore, wood importation.

Lorraine is considerably less wooded than Alsace, namely, only 26.4 per cent of the forest area of the two provinces, three-quarters of the Alsatian Mountains, being covered with the celebrated fir forest. Practically the extent of forest area has remained the same under German rule, the few thousand acres cleared for special purposes being compensated by waste-land planting and, as far as State forest is concerned, by purchases.

The forest is very varied in composition and conditions. In the valleys, broadleaf trees, oak, beech, elm, poplar, etc., and Scotch pine (natural growth); in the mountains, silver fir, with beech, Scotch pine, ash, and in very limited areas Norway spruce. The Scotch pine here becomes a mountain species and finds its southwest limit. Two-thirds of the forest is deciduous. The State forests are richer in oak, while the communal forest is richer in fir. In Alsace, communal forest; in Lorraine, State forest predominates. Altogether, 45 per cent (in one section 67 per cent) is municipal forest and 20 per cent private, leaving over 30 per cent to the State; the details of distribution of ownership

are given in a table and the property changes are historically traced. The majority holdings of the municipalities lie between 50 and 500 acres in size. The private forests originate mostly from sales of State property and are mostly small, over 90 per cent less than 25 acres.

The organization of the German State forest administration is then described, this being the only forest of which the empire as such was owner. A Landesforstmeister, three Oberforstmeister, or district officers, with a council of Forsträte, and a bureau of working plans; 64 Oberförster in charge of the rangers, increased in number over the French régime from 46, averaging about 10,000 acres; assistants 16 (Revierförster), Hegemeister 43, and 720 guards formed the personnel—altogether around 900 officials to manage, say, 350,000 acres. The methods of administration are elucidated, and especially the fact is accentuated of the autonomous position which the Oberförster (supervisor) occupies. This decentralization the author considers desirable and to be envied, as also the right to the chase of small game, which the French foresters do not have.

Another advantage of the German administration is that the logging is done under the direction of the forest officials, doing away with a lot of undesirable regulations, which hamper the French administration; but, to be sure, also inviting some risks which the author recognizes.

The most interesting part is the account of silvicultural management and changes accomplished. Under the French régime there were still 65,000 acres of coppice in the State property, 40,000 of which in conversion to timber forest. By 1898 it was all converted, but the author claims that, due to ignorance of proper conversion methods (namely, by planting instead of gradual change by natural regeneration), these converted areas have become lamentable failures, mismanaged coppice rather than timber forest.

A subdivision into compartments according to Prussian method, in plain rectangular, in mountain following contours, and doing away with the French multiplication of small felling series, the author approves, as well as of the abandonment of a strict annual sustained yield management for each small unit.

But an "absolutely deplorable" innovation the author finds in the almost general abandonment of natural regeneration and adoption of the "Prussian" system of clear cutting and planting, which naturally gives preponderance to pine and spruce over the hardwoods, and, in order to meet the cost of this method, has led to a reduction of the wood capital by lowering the rotation and to the cutting of the reserves of old oaks, which the French are proud to accumulate.

The author admits that in the fir forest of the Vosges these accumula-

tions had been excessive, but thinks even here the cutting has been too severe and the procedure "robbery."

The communal forests of Alsace are mostly in timber forest, while those in Lorraine are coppice with standards, of which the "Prussian Oberförster had not heard before" and certainly will not have improved them.

The production of all forests in Alsace-Lorraine was estimated in 1900, in the absence of definite data for private and communal forest, at 52 cubic feet timberwood, of which 45.8 per cent was workwood. The exact statistics of the State forests for the first 25 years of German occupancy show an output of almost 60 cubic feet, with a workwood per cent of 70 and a sawlog per cent of 33, which later rose to 45 and 48.

The money returns from 1872 to 1893 varied between $3 and $4.30 gross per acre and year; in 1908, it had passed the $5 mark, of which 57 per cent for expenses (in 1910 48 per cent), and shortly before the war this represented 11 per cent of the total State revenue of the two provinces as against 3.9 per cent for Prussia and 9.5 per cent for Bavaria, and hardly 7 per mille for the French State forests. The average price for wood came in 1908 to nearly 9 cents per cubic foot.

The author complains of the generous salary list and general extravagance of the administration at the expense of the provinces; the personnel in 1908 took 29.1 per cent of all expenses as against 15 and 18 per cent for the Bavarian and Prussian services.

In the final section of the article the author gives advice how to reorganize the forest administration of the returned provinces. It is interesting to note that most of the administrative changes made by the Germans are thought to be acceptable. In this connection we translate *verbatim* the interesting characterization which Huffel gives of his compatriots and their peculiar democracy:

"Order and clearness are eminently characteristic qualities of the French spirit. The passion for uniformity, the centralization to the utmost are deformities of these beautiful qualities. The forceful hand of Richelieu and of Colbert, and that still mightier and more tyrannical one of Napoleon, have made of our dear France the most centralized, the most uniformed, the most autocratically governed country in the world."

The author deplores this and constructs an administration in semblance of the Prussian democratic one, in which the supervisor has the management really in his hand.

The clearing and planting of conifers, to be sure, is anathema and must be abolished!

Les Forêts de l'Alsace-Lorraine. Revue des Eaux et Forêts, December, 1918, pp. 265-280.

EDITORIAL COMMENT

Correction

An error unfortunately occurred in the editorial entitled "Is Public Purchase of Private Timberlands the Only Solution?" published in the February JOURNAL OF FORESTRY, which we hasten to correct. The resolution upon which the editorial comments, as originally written and debated, contains the word "saw" material—not "raw" material, as printed in the JOURNAL. The typographical error occurs both on page 192 and again at the top of page 222. This typographical error, however, does not affect the validity of our argument.

Silvicultural Problems

Several contributions in the recent issues on silvicultural problems exhibit strikingly the modern method of approaching their solution by painstaking detail statistical inquiry.

When 150 years ago Oettelt proved the thesis that "mathematics could be made useful to foresters," he probably hardly realized that this truth extended even to silviculture. Wholesale observation and judgment were then the guides of the silviculturist, just as in medicine and all other art and business that had to do with nature, and although exact research has advanced these arts, no doubt, general observation and judgment must still form a large share of the equipment of the practitioner. While we welcome the precise methods of the plant ecologist, which seek to establish the sure basis for the practice of silviculture, we must caution him against the danger of omitting the observation of factors in the problems which are historical and hence withdrawn from his direct observation and of premature deductions. There are, for instance, two such factors in natural regeneration which may explain the result or two unlike results under otherwise precisely similar conditions. The one is the occurrence or non-occurrence of a seed year; the other is the weather at the time of germination and for the first two or three years.

Especially the latter factor, varying from one locality to another, and, moreover, varying in its importance, is difficult to give proper values for co-ordination. This explains, also, the observation of Dr.

Howe, that foresters—and physicians do the same—differ as to best methods for given cases and are opinionated about it.

The writer belongs to the same guild of opinionated silviculturists when it comes to a proposition of treating the hardwood-conifer type of the Adirondacks, and does not need the exact proof that if in a mixed herd of cows and pigs you slaughter only cows, pigs remain. It only needs common sense to see that the competition of the hardwoods must curtail the chances for the conifers. The writer has seen no reason for changing the language he used in 1903:

"There is one fact on the silvicultural side which the experiment has demonstrated to the satisfaction of the writer, namely, that in the hardwood forest of the Adirondacks, where the pine and spruce have been severely culled, the only practicable method, both from financial and silvicultural points of view of securing a desirable new crop, is a clear cutting system, followed by artificial regeneration of the conifers, leaving only enough of the hardwoods to produce an admixture by natural regeneration, and saving only so much of the promising volunteer growth of young hardwoods and conifers as is not liable to be thrown by the winds."

This was said in challenge of the propositions detailed in "Practical Forestry in the Adirondacks," which has proved such a bad prognosticator, although it had its value as an educator.

Timber's Horn of Plenty

Under the above caption, a writer in the *Hardwood Record* tries to discredit the idea of shortages in timber supplies, charging to bad guessing the continuance of certain supplies that had been predicted as soon to give out, black walnut and white pine in particular. He fails to mention that to find the necessary amount of walnut for gunstocks a close hunt in fence corners and ornamental grounds was necessary, and that at the same time substitutes were assiduously sought for and used. He fails to mention that the cut of white pine has dwindled from over 8 billion feet to less than 3 billion and the price for the best grades has more than quadrupled in a short time—a sure sign of the exhaustion of supplies; and we could explain why the whole white-pine business has not yet gone entirely out of existence, and that the guessers were not so wrong after all!

The writer also says it was a surprise to find in France and England timber supplies enough to keep the Canadian and American forestry battalions busy.

There was, of course, nothing surprising or unknown to the French regarding their timber resources, and a country which imports annually

from 30 to 40 million dollars' worth of lumber is not likely to be overstocked with timber. As a matter of fact, of the 23 million acres of forest in France only 25 per cent is what is called timber forest; the rest is coppice, good for fuel and small dimension, though about one-half of this contains also dimension timber (standards). Now, the bulk of the timber forest is in government hands, and the government practices a "sustained-yield" management. The cautious French, in addition to having all the age classes needed for such a management, are conservative and leave 25 per cent of what they would be entitled to cut under this management as a reserve against an evil day, such as fires, insects, windfalls, or perhaps war may bring. It is this reserve that has fallen under American and Canadian axes, and, in addition, the older age classes below the 100 or 120 years, perhaps down to 80 or even 60 years, which can be made useful. In a special case, in which the mill was run by one of our professors in the forestry battalions, he ascertained that they were anticipating the cut of 20 years, and, moreover, most of the cut was fuel wood. The sustained-yield management is badly crippled in all French forests by these anticipated harvests. The expectation of the writer that home supplies will suffice for reconstruction purposes is probably a futile guess.

A writer in the *Revue des Eaux et Forêts* (1918, p. 244) discusses what has become of the pineries of France, which are mostly the result of planting up waste lands (some 2 million acres) in the following language:

"The irreparable damage caused (by the clear cutting) in our pineries has ruined for a long time the effort and work of two or three generations, and in any case has created a disquieting situation for the future. . . . The realizable, accessible timber has been cut. The requirements still necessary to satisfy will take the younger stands which have not yet fulfilled their rôle."

Future of Cut-over Pulpwood Lands in Quebec

During the summer of 1918 Dr. C. D. Howe, for the Canadian Commission of Conservation and in co-operation with the Riordon Pulp and Paper Company, began an investigation into the conditions of some of their cut-over limits. On some 130 acres of sample areas in five forest types, lightly, moderately, and severely culled of spruce and balsam, careful count of the remaining smaller growth of these species was made and tabulated in three diameter classes, namely, 12 inch and over, 8 to 11 inch, and 4 to 7 inch. The legal diameter limit being 12 inch, the next cut would come from the 8-inch trees in 30 years, according to the ascertained growth rate.

While this investigation is to be continued, it is already possible to foreshadow conclusions.

"It is a common belief among lumbermen that the logs they get on cut-over lands come from the trees which were too small to take at the previous cutting; that they can go back to an area every 10 or 15 years and get a profitable cut from what has accumulated by growth during the interval. These growth studies indicate that this is a mistaken opinion, since in the mixed forest it requires about 60 years for a spruce tree 4 inches in diameter to reach a diameter of 12 inches, the legal sawlog size. In addition to this, the tables conclusively show that with each cut the lumberman takes an increasingly large proportion of the smaller spruce trees. During the past five years a large percentage of the cut, so far as the number of trees is concerned, has been below the legal diameter limit for spruce. The tables also show that with each cutting a larger proportion of balsam was taken."

A Policy that Pays

In these troublous times of industrial uncertainty and labor turnover, it is refreshing to find among lumber operators those who are able to maintain their forces through social service. The Nippon Lumber Company, adjacent to the Snoqualmie Forest, is the latest of these to come to our attention. Hampered as they are by the fact that there is no possibility of a permanent community being developed and of the men establishing permanent homes because of the elevation and climatic conditions, the company is making the most of its opportunities. As many married men with families as possible are employed, and a general policy of paying wages slightly higher than the average attracts and holds the best labor available. This has resulted in building up a force of nearly permanent employees, with an exceedingly small turnover. An annual dinner and dance are given by the company every winter, and an attractive annual booklet is published, which is well illustrated and gives a calendar of the events in the community, work and activities of the various clubs and organizations which are encouraged by the company, the organization of the force of employees, the pupils in the school, and other similar interesting features. That this work is a decided success is attested by the fact that it is now in its ninth year.

The company has adopted as its creed:

> "We believe that under a free and full competition every worker of every degree will receive all that he produces, and we believe that he should receive the full amount of that production without deduction and without division."

Western Australian Forestry

Western Australia has entered the forestry world with most radical legislation as a result of a short period of propaganda by a committee and the conservator, Lane Poole. The striking features of the legislation are the removal of the forest branch to the Department of Mines from the Department of Lands, the former being supposed to act more disinterestedly in questions of land matters.

The Conservator of Forests is placed in office for seven years, removable only by a vote of both the lower and upper chambers of the legislature. He is given all powers of a commissioner over all West Australia forests, now estimated at 3,000,000 acres, of which 1,300,000 acres have been cut over and 1,500,000 acres are under lease.

The conservator is furnished with a definite source of revenue, without the necessity of each year going before the legislature, in that one-half the forest revenue is each year set aside for forest work under his direction. This will amount to about $135,000 annually, as compared with about $60,000 expended in 1914-15. As the program develops, it is anticipated that additional funds will be provided.

The setting aside of forest reservations by the conservator and elaboration of working plans are to have force of law for ten years and the conservator is empowered to organize his own department. A planting campaign on the waste lands is also provided. Further details may be found in the *Canadian Forestry Journal*, February, 1919.

The report of the forestry subcommittee of the Reconstruction Committee, contained in that of the Development Commissioners of Great Britain for the year ended March 31, 1918, has been issued. The commissioners had set forth the advantages of leasing and proceeds-sharing in their scheme of reforestation as compared with a system of land purchase, and these methods have been approved by the reconstruction subcommittee, with a view to reducing expenditures necessary in case of acquiring land by purchase. The extensive felling of forests during the war has emphasized the national importance of home-grown timber supplies, and the commissioners urge the importance of the immediate preparation of afforestation schemes. They recommended grants for extension of State forest nurseries, for preliminary arrangements for leasing and other proposals for afforestation of privately owned land, for survey work, and for salaries of forestry officers for advisory survey and research work. Carrying out the suggestion that they consider the suitability of the areas for schemes of economic forestry and submit definite proposals for areas for which the department is pre-

pared to frame and carry out schemes, the department states that about 10,000 acres have been cleared during the last four years on private estates and on the department's forest lands, and that 750,000 seedlings (a bagatelle!) are in hand, in addition to the product of the sowings in the season 1918. In case there should be a deficiency when planting operations on a large scale will become operative, attention is being given to the provision of nursery stock. It is estimated that 40,000,000 seedlings were produced by the close of 1917, and about one-third of the total growing stock is available for the afforestation of some 5,000 or 6,000 acres. Application has been made for a grant to aid in cost and maintenance of a proposed school of forestry in central Scotland. The commissioners, though sympathetic with the proposal, were not prepared to recommend the advance under existing circumstances. The commissioners were informed that the Secretary for Scotland, looking in particular to the felling of Scottish forests during the war, was satisfied that Scotland was ripe for definite afforestation schemes.

NOTES

A Handy Relation

American foresters in France were, of course, much interested in French stumpage values. So many francs per cubic meter for the standing trees meant nothing to us; we wanted to know in the units of volume and value that we were used to, so that we might compare French with American timber values. Many pencils were sharpened to make the translation, and the differing results sometimes brought on warm disputes. The writer, like many others, no doubt, finally found an easy rule of thumb to simplify the difficulty.

One cubic meter of round material, of the sizes which ordinarily occur in trees from 12 to 20 inches in diameter, contains approximately one-fifth of 1,000 feet board measure log scale. One franc has a value of approximately one-fifth of one dollar. Hence stumpage valued at 20 francs per cubic meter is worth approximately $20 per 1,000 feet board measure.

Southwestern Supervisors Hold Conference

How to obtain an accurate inventory of the timber of the Southwestern National Forests, to determine the extent of past cuttings, to secure growth and yield figures; in short, to lay a better foundation for scientific management of the forests, was one of the chief topics of discussion at a meeting of 15 supervisors and the district officers of the Arizona and New Mexico Forests, held in Albuquerque, New Mexico, during the week beginning February 10. A workable scheme for an extensive program of silvicultural management was presented and approved. Many other problems of forest administration, particularly those dealing with publicity, land classification, education, game, fire protection, and grazing, were debated. The timber-sale business in the Southwestern district is large. In the fiscal year 1918, 121 million feet were cut under sale contracts, having a value of $273,500.

At this meeting was displayed a device for more accurately determining the location of forest fires, invented by W. H. Gill, of the Albuquerque office of the Forest Service. The device, called a cameragraph, is a proposed substitute for panoramic maps which have been exten-

sively used in both eastern and western forests, especially in connection with the Osborne "fire-finder" in the northwestern forests.

Canadian and American Forestry Battalions

From an interesting account of the forestry work of the Canadian and American forestry battalions overseas by Major Barrington Moore, second in command of the United States Forestry Corps, before the Canadian Forestry Association, we quote in full the following account of the operations:

The organization of the American forestry section was patterned largely after that of the Canadian Forestry Corps. When Colonel Graves and I landed in France, in June, 1917, we went first of all to the British Forestry Directorate at La Touquet. General Lord Lovatt received us with the greatest friendliness and gave us complete data, which he had prepared in advance, covering his entire organization and equipment. Then, after a trip to the Canadian operations under Colonel Johnson on the Government forest of La Joux, in eastern France, and after working over the information collected, we drew up a cable, outlining the organization of the forestry troops required by the A. E. F. We based our requirements on an army of two million men, and asked for 18,000 forestry troops, of which 7,500 were to be skilled lumbermen, about 4,500 engineer troops for road and camp construction, and about 6,000 unskilled labor. At the same time we requested 12 officers to come over at once for our overhead organization. These officers we asked for by name. They arrived in about two months, in time to be of great service in acquiring standing timber and other preparatory work. The unit of the Canadian Forestry Corps is the company. We made ours the battalion, on account of our army regulations. It was hard at first to make our superiors see the need for elasticity. Forestry troops were an entirely new venture. The number of men in the actual operations depended entirely upon the needs of the case. Sometimes only 50 men would work together, and then again we would have a thousand or more.

The standing timber was all bought through an interallied committee composed of French, British, and Americans; later the Belgians were represented. We ourselves selected each forest, in company with a French officer, and then laid it before the committee. The negotiations with the owner and purchaser were done by the French. The French possessed the right of requisition, and used it effectively, saving millions of dollars and defeating the swarms of speculators which buzzed around us like flies around the honey pot. By persistent efforts we managed to acquire timber enough to keep ahead of the operations. But toward the end it was becoming more and more difficult to find reasonably accessible tracts. Accessibility was of prime importance in selecting timber, because of the need for rapid production. If the war had lasted we would have been in a difficult position. When it ended, we were planning to do railroad logging in the mountains.

Logging conditions varied greatly. The southwestern pineries are as level as a table, except for the dunes along the edge, and resemble our southern longleaf pine country. Central France is level or rolling, the chief obstacle being

the heavy, sticky clay. Here the forests were mostly oak, which we cut into ties, wharf timbers, and road plank. The silver-fir forests of eastern France were in the mountains. Our chief trouble there was the narrow-gauge railroads, which never had enough cars or engines. The same kind of narrow-gauge railroads bothered us in other regions as well.

When we consider that the modern army is helpless without wood, I think it is safe to say that the French forests were one of the big factors in winning the war.

The *Journal of Heredity* for October, 1918, contains an account of oak hybrids raised by the horticulturist to the Texas Experiment Station from the overcup oak (*Q. lyrata*) and the live oak (*Q. virginiana*), the latter being the mother. Both belong to the Lepidobalanus subdivisions of the genus, though differing widely in a number of features. The hybrids were very uniform. In general habit the father, with its pyramidal form and straight shoots, was dominant. The leaves were intermediate in size, but resembled those of the father in being lobed. The form of the acorn, however, was very much like that of the live oak, though larger in size. The leaves of the hybrids commenced to fall in the winter, but many of them remained green until the spring. In this feature, therefore, the hybrids were intermediate. An interesting point is that hybrids like these have been found sometimes growing in the natural state, and were described recently by Professor Sargent under the name of *Q. comptonæ*. They grow rapidly, the earliest raised having reached a height of 16 feet in 8 years from the time of sowing, with a diameter of 5 inches a foot from the ground. Owing to the density and luster of their foliage, they are superior to both of their parents as ornamental trees. The wood is very hard, close-grained, and tough.

A supervisors' meeting was held in Missoula, Mont., from February 10 to 15. Twenty-four of the twenty-six supervisors in the district were present, as well as members of the district office. The object of the meeting was a careful study and analysis of organization and personnel problems. The preponderance of opinion was that authority and responsibility should be placed close to the ground and the personnel in the woods be both increased in number and strengthened in quality. "Forester" was the title thought to be most appropriate for the officer in charge of the basic field unit. If the Forest Service adopts the recommendations of the supervisors, a material reduction in the overhead organization will be possible. A banquet was enjoyed at the Florence Hotel on the evening of the 13th. Seventy-five were pres-

ent, including forest officers and friends and those employed in related activities.

A new branch of the Canadian Forestry Association, to be known as the standardization committee, was authorized at the annual meeting at Montreal. The committee's work is primarily to endeavor to standardize fire laws and regulations, forms and reports, fire-warning posters, publicity literature, etc., tools, equipment and supplies, mechanical equipment and accessories; also to seek, encourage, experiment with and develop new ideas, methods, and apparatus—all in connection and allied with the profession of forest-fire protection. Wherever standardization can be arrived at, it is suggested that one of the benefits protective organization can secure is a reduction in the cost of such items as posters, publicity literature, tools, mechanical apparatus and accessories by combining their orders for such items with those of other organizations.

J. A. Larsen, in charge of the Priest River Experiment Station, has made some further contribution to the subject of the occurrence of tree seed in the duff. Thirteen samples of two square feet each were taken from an area bearing a heavy stand of white pine and species common to the type. The seed were sifted out from each sample of duff and counted. Using the figures obtained, the number of apparently good seed to the acre is estimated as follows: White pine, 192,635; Douglas fir, 5,027; western larch, 88,807; western hemlock, 5,027; western cedar, 1,892,000; white fir, 62,842; Engelmann spruce, 1,676. The seeds taken from the samples of duff will be tested for germination to secure a basis for determining the seed per acre which are capable of growth.

A fire conference was held in Spokane, Wash., January 13, 14, and 15. Thirty-nine were present, which number included members of the district and supervisors' offices, representatives from the Idaho protective associations, and several visitors from neighboring districts. Fire plans were discussed with reference to the experiences of the past several seasons and needed revisions made in policy and procedure. Detection, suppression, co-operation, publicity, and revision of forms were among the subjects discussed. Through the assignment of major subjects to committees, which prepared reports and recommendations for the approval of the meeting at large, the entire ground was covered in a relatively short time.

The U. S. Forest Products Laboratory, at Madison, Wis., has developed a method of making laminated gunstocks which would without reducing the strength permit the use of the small pieces of walnut not suitable for single-piece stocks. This would facilitate production and result in appreciable saving in costs and material. The application of laminated construction to many articles of trade is a development worthy of close study. Work is being done at the laboratory on the drying of willow for artificial limbs. While air-seasoning takes from three to five years, experiments seem to indicate that the drying can be done in kilns in from 60 to 70 days.

A bill which provides for the acquiring of land by the Government through exchange with private owners holding land or timber within two miles of the present Lolo, Missoula, and Bitterroot National Forests is now pending in Congress. Only such land as is chiefly valuable for forest purposes is considered for acquisition by the Government, and provision is made for the giving of agricultural land, timber, or certificates redeemable in timber, in exchange. Timber purchased on certificates is to be removed under the Forest Service timber-sale regulations.

The Dominion parks of Canada, which are maintained as wild-life sanctuaries, include an area of 7,927 square miles, or more than 5,000,000 acres, nearly equal to one-half the total area of Switzerland, almost as large as Belgium, and nearly 1,000 square miles greater than the area of Wales. Jasper Park alone, which includes 4,400 square miles, is larger than Montenegro and almost twice the size of Prince Edward Island, as shown by data furnished by the Dominion Parks Branch, Department of the Interior.

The Governor of Idaho is favoring a reorganization which embodies a change in the method of administering the State forests. There is an opportunity for the formation of a strong and progressive administrative body which will co-operate to the best advantage with the several protective associations of the State and the Forest Service. The organization of a non-political State forestry board and the appointment of a competent State forester are contemplated.

New regulations issued by the Federal Horticultural Board of the United States Department of Agriculture governing the importation of plants, etc., into the United States, coming into force on June 1 next,

are of a most drastic nature, going so far as to exclude the importation of all nursery stock, with the exception of "certain bulbs, rose stocks, fruit stocks, cuttings, scions and buds, and seeds of nut, fruit, forest, and other ornamental shrubs," for which permits must first be obtained.

When the president of the Canadian Pulp and Paper Association at the meeting of the Canadian Forestry Association takes up the extravagant estimate of pulpwood to be found in the Province of Quebec, made in 1904 by Langelier, inspector of forest rangers, and by making proper allowances for loss and increased cut, comes to the conclusion that the province may not be able to supply the requirements for 25 years, the situation must be indeed alarming.

Norway is to help France restore her forests in the devastated areas in the north, from Ardennes toward the Belgian frontier behind Arras. The plan is to plant 250 acres annually for five years, using mainly Norwegian forest trees, the work to be done by Norwegians, fully equipped with material, tools, stores, etc. The money to finance the scheme is now pouring into Consul Heiberg, at Christiania.

A recent policy formulated by the district and Washington offices prohibits the grazing of stock on forest land classed as white-pine type. The ruling applies particularly to burns within the white-pine type where grazing tends to prevent or injure reproduction. Where the grazing of such areas is already being carried on, an adjustment period will be allowed within which to remove the stock.

With the return of a number of men from France, the timber-survey work which was discontinued in 1917 in Montana and Idaho, it is hoped, will soon be resumed. Even with the return of all men now in the Army, the number of experienced men will be below normal, and it will be necessary to build practically a new organization, using students and available forest-assistant material.

Supervisor R. P. McLaughlin is investigating the paper and pulp markets in the Middle Western States. This work is being done to determine the advisability of encouraging the location of paper and pulp plants in the vicinity of the extensive spruce stands of northwestern Montana.

The State Forester of Montana has proposed a revised fire law for the State which is receiving favorable consideration. One of the important points of the proposed law is the provision for a permit system and closed season.

The Bureau of Standards has published "A Metric Manual for Soldiers," the aim of which is to give to the soldiers a grasp of the metric system, which will enable them to think and work in metric units. No tables of equivalents need be memorized. A number of tables and a vocabulary are given for reference. The units are described by actual examples likely to be encountered in military work.

At the annual meeting of the Canadian Forestry Association, in Montreal, on January 29, J. S. Gillies, of Gillies Brothers, Braeside, Ontario, was elected president for the year 1919; Clyde Leavitt, vice-president; P. B. Wilson, of the Spanish River Pulp and Paper Mills, a new director, and Hon. E. A. Smith, territorial vice-president for New Brunswick.

Figures recorded at the customs department of Canada show that the exports of maple sugar and sirup increased in 1918 over those of 1917 by 20 per cent and in value by 76 per cent. The Canada food board hopes that producers will make even a greater effort this year, natural production of all kinds being the duty of the day.

The forest region of Ontario, covering an area of over 100 million acres, subjected to the forest fires prevention act, is divided into 35 districts, each in charge of a chief ranger, each of whom, in 1917, was assisted by 34 deputy chiefs, the maximum number during the season being 1,039.

At the annual meeting of the woodlands section of the Canadian Pulp and Paper Association, at Montreal, on January 30, the following officers were elected: Chairman, R. P. Kernan, Quebec; Vice-Chairman, M. P. Small, Grand Mère; Councillors, R. F. Kenny, Buckingham; A. J. Price, Quebec, and Ellwood Wilson, Grand Mère.

Maple trees are to be planted on the graves of Canadian soldiers in France and Belgium. For this purpose seedlings have been raised at the Royal Botanic Gardens, London, England, from seeds sent overseas by the Dominion Horticulturist, Ottawa.

John S. Baird has re-entered the Service as a lumberman and is now employed on the Kootenai National Forest. Mr. Baird resigned in 1910 and was employed by a lumber company in northern Missouri.

The Laurentide and Riordon Paper Companies have co-operated in buying 1,500,000 spruce trees to plant this spring, in addition to those from their nurseries.

Major D. T. Mason has resumed his former duties as Professor of Forestry at the University of California.

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A NATIONAL LUMBER AND FOREST POLICY[1]

By HENRY S. GRAVES

Chief Forester, U. S. Forest Service

The policies of the Government and the States during the next few years in matters relating to forests and lumber will be of far-reaching importance. Conditions created by the war present certain problems of urgent interest to the lumber industry that will require definite action by the Federal Government. Among them are problems of railway transportation, exports, ship-tonnage, taxation, labor relationships, and special questions relating to the orderly transition to peace-time conditions. There are other conditions and situations, however, which both from the standpoint of the lumber industry and of the general public welfare demand constructive action.

VITAL INDUSTRIAL AND PUBLIC INTERESTS INVOLVED

The fundamental economic situation that has heretofore kept the lumber industry in a state of unstable equilibrium still exists. Labor problems, in considerable part due to the unsound industrial situation, loom up with no permanent adjustment in sight. The dissipation of our forests goes on with no let-up, and still for the most part without any provision for the continuance of the forests after lumbering. Exhaustion of local forest supplies, the closing of industries dependent on them, the embarrassment for supplies of the pulp mills and other consumers using special classes of forest products, the generally mounting prices to consumers, are other factors which are calling sharp attention to the effect of forest destruction, and are causing increasing public uneasiness.

Lumbermen are giving thoughtful study to the needs of the industry; and they recognize that many things of a helpful and constructive

[1] An address delivered before the American Lumber Congress, April 16, 1919, at Chicago, Ill.

character can be done within the industry itself, in the way of cost accounting, adaptation of manufacture to the needs of the trade, scientific merchandizing, economies in manufacture, conservatism in finance, diffusion of information about production, markets, price movements, existing stocks and shipments, and so on. I judge that progressive steps are very generally under way in such matters, and that lumbermen are going as far as they can to improve the internal situation. There are other things that can be accomplished through co-operation with existing public agencies, as in economic, industrial, and technical research, and in demonstration of technical methods. I believe that a great many valuable things for the lumber industry can thus be brought about.

But neither the lumber industry nor the public can ignore the fact that the great fundamental problems, which not only involve the permanence and stability of the interests dependent on our forests, but also gravely affect the national welfare, are not being solved. These problems fall into four general groups; those relating to the causes of over-production, those that concern the supply, character, well-being, and stability of labor, the problem of the continuance of private forests and of stumpage supply, and certain questions relating to our public forests.

THE LUMBER INDUSTRY STILL UNSTABLE

We must frankly recognize the fact that the elements that caused the unstable condition of the lumber industry prior to the war still remain, and constitute a danger for the future. To recall the situation at that time and the principal cause of trouble would be only to repeat the oft-told story of the speculative character of ownership of timberlands, the pressure to liquidate, the difficulties of financing stumpage, the excess mill capacity, the unorganized character of the industry, and various like matters; all contributing to cause premature cutting and over-production, with its depression, losses, failures, interrupted operation, intermittent employment, and other ills. We may be able to point out certain elements of strength that may tend to steady the industry for a time, but we still have a great factor of uncertainty in the existence of large bodies of timber which their owners are seeking every opportunity to place on the market, and in many cases will be forced even at a loss to manufacture, because of financial pressure. Whenever markets improve there is the inevitable tendency to increase production to utilize surplus mill capacity, and there are

always interests ready to inaugurate new mill enterprises when improved transportation or other factors seem to offer a favorable chance for an undertaking.

These are essentially the conditions that make for a periodic overflow of production and create unstable conditions. Some persons may be so favorably situated in the matter of high-grade products, low-cost production, or other factors, that they can meet even the extraordinary fluctuations of industrial conditions. But for the industry as a whole there exists an element of uncertainty because of the urgent pressure of stumpage for production. I do not see how there can be a permanent basis of conservatism, stability, and industrial strength so long as this condition exists.

The public is concerned because of the injury and loss that accompanies demoralized industrial conditions, and because under such conditions there is increased waste in lumbering, protection from fire is less efficient, and the difficulties in the way of forest replacement are intensified. Failures that occur at such times often result in a transfer of lands, thereby increasing the tendency to centralization that may operate disadvantageously to the public in the long run.

THE LABOR PROBLEM

Of far-reaching importance both to the industry and to the public is the problem of labor. It is the problem that is most insistently pressing, and perhaps in some aspects the most perplexing of any before the industry. Some features are peculiar to the lumber industry, and the ultimate solution will doubtless require a program especially adapted to the conditions of the forests and the sawmills. Temporary adjustments will doubtless be found, but a final solution will come, I believe, only with the placing of the lumber industry on a basis of stability and permanence.

THE PROBLEM OF WANING TIMBER SUPPLIES

Any serious consideration of the conditions requisite to a sound lumber industry brings us face to face with the question of raw materials, the husbanding and careful use of existing supplies, and the renewal of our forests after lumbering. We have been lulled into a feeling of security in recent years because we have an estimated total quantity of standing timber in excess of twenty-five hundred billion feet. The very situation to which I have referred, of industrial instability due to the pressure of large quantities of stumpage for production,

adds to the impression that we have so much timber in reserve that we do not need to concern ourselves about supplies of forest materials. Not only the public, but many economists, have been misled by statistics showing the aggregate of timber still standing in the country.

Forest depletion is injurious long before the last tree is cut, and long before all but the last center of production is exhausted. Oftentimes our minds are centered on total production and general markets, overlooking the relation of the forest and its industries to the life of the regions and the communities in which they are located. When local resources are so depleted that industries close, the question of vanishing supplies takes on a new significance. And that is exactly what is happening in hundreds of communities. The forest supplies are used up; the chief industry, a sawmill, a box factory, or a woodworking establishment closes. Subsidiary industries dependent on the primary undertaking have to close also. And what is more, the land formerly producing the timber, if non-agricultural, is left in an unproductive condition and a burden for many years on the community.

Many important wood-using industries are already embarrassed for supplies. Especially acute is the situation faced by the manufacturers of news-print paper in the Northeast, in the Lake States, and elsewhere. Enormous investments have been made in permanent mills, water power, and equipment. The local sources of supply of pulp wood are becoming rapidly exhausted. Because of this situation and because of the difficulties in obtaining raw materials from Canada we have seen the new construction of mills taking place only in Canada, largely with American capital.

Other industries using special wood products are equally embarrassed. Some are able to secure materials from a distance; others have to close and move to new sources of supply.

Because there is still an abundance of timber in the far West, the East and central West cannot complacently see the basis of their own industrial prosperity destroyed. In short, we have in many localities a very real problem of shortage of forest supplies, and very real consequences of forest depletion.

FOREST RENEWAL NOT PROVIDED FOR

The problem of supplies does not merely concern the amount and character of timber now standing. It concerns as well the production of new crops of timber by growth. I would have little concern about the amount of timber used if we were growing new stands in place of

the old. We have enough non-agricultural land to produce for all time lumber in abundance, for ourselves and for export. But this would require keeping our forests in a productive state after lumbering. We are not doing that. Our forests are steadily deteriorating under cutting and fire. No effort is made for replacement after cutting. Fire protection is confined to old timber. Young growth and cut-over lands are not being protected. Accidental stands following cutting and fire are generally poor in quality and species, and of low prospective yield. We are still drawing for the most part on original sources of supply. Failing to replace these, we are steadily losing ground. We are actually using up our forests, just as we would use up a deposit of coal, when we might have been renewing them.

The question of forest renewal and growth is one that can no longer be ignored. It is not only of interest to the public, but it is of vital concern to the owners of timberlands. It may be said that reserves of timber ought to be held by the public, rather than by private owners. A good many assert that the growing of timber is wholly a public function; that as most timberland owners have bought their property to exploit their timber, not to grow trees, forestry and forest growth are not matters of private concern. But the fact remains that the bulk of the timber of the country is privately owned, three-fourths of it. It is an important fact, also, that the bulk of the land that must grow the timber of the future is privately owned.

The transfer of the great bodies of timber from public to private hands was a grave mistake of public policy. It is not possible to conceive of a method better calculated to bring about a rapid dissipation of our forests than was actually used by the Government in disposing of its timberlands; nor could a surer method have been devised to bring about a condition of industrial uncertainty. The lands were parcelled out as fast as possible in small lots and under conditions that inevitably encouraged speculation. It was only a question of time that every owner should undertake to dispose of his land or timber to realize on his speculation. We now see that a different method of administering the public forests should have been adopted. But the action was taken and we cannot undo it, nor can we ignore the problems that are resulting from it. The custody of the bulk of our forest resources was intrusted to private owners. The burden of carrying the timber and properly caring for it was transferred from the public to private hands. Whether they like it or not, the private owners have the problem of the right handling of a large part of our forests actually on their hands.

AN IMPOSSIBLE SITUATION

On the other hand, the public has a very essential interest in the question of keeping the lands in a producing condition so as to render a maximum of service, in supporting industries and local communities, and in serving to support through tax levies public enterprises of various kinds. Even though the public has surrendered its direct ownership of the timberlands, it cannot afford to permit them to be handled in a way to be injurious to the welfare of the community. The various benefits required of forests, from their products, support of industry, etc., can be obtained only in part from the existing public forests. They are not extensive enough or widely enough distributed to meet more than a part of the public needs. We must continue to rely in considerable part on private lands, both for present supplies and for growing timber for the future.

We have then a perplexing dilemma. On the one hand the public is deeply concerned that the private forests be handled in a way to provide for forest renewal and growth. We have on the other hand the timber owners struggling under a responsibility that has never been fully sensed or accepted. The result is that while considerations of public interests demand that something be done, nothing substantial is actually being accomplished. It appears to me that the situation is an impossible one, that cannot long continue. Both the industry and the public have a definite decision to make. As I see it, either private owners must assume the full responsibility of properly caring for their timberlands, including protection and forest renewal; or the public must take over the responsibility that it once had and surrendered; or the public must share with the owners both the responsibility and the burden of securing the objectives that are essential to safeguard the public welfare. My own view is that the last is the only fair and practical method from the standpoint of all concerned.

PROBLEMS RELATING TO PUBLIC FORESTS

But there is a fourth group of problems. Not all of the forest lands passed into private hands. When the policy of deeding away the public timberlands was at last found to be an unsafe one for the Nation, it was changed and the bulk of the remaining public timberlands were withdrawn from private appropriation and segregated as National Forests. In this way about 155 million acres, nearly all in the western mountains, were reserved. For these public timberlands the public is doing what should also be done for the timberlands that

passed to private owners. The public forests are being protected from fire, the timber is used as it is called for by economic conditions, and the cutting is conducted by such methods as leave the land in favorable condition for the next crop of timber.

There are definite policies of handling our National Forests and their resources. There is, however, no public or national policy that takes into consideration all the forests of the country and correlates their problems and development. This is true also of the regions in which the public forests are located. The manner in which the public timber is handled may vitally affect the lumber industry. The problems of the lumber industry may affect the interests of the Government in the administration of its own forests. There remains yet to determine what shall become of the cut-over non-agricultural lands, to what extent these shall be taken over by the public, especially those on critical water-sheds and on steep slopes. There are various other questions relating to public forests, their extension and use, that require to be considered in connection with any program that looks to the whole forest situation of the country.

A BROAD PROGRAM NEEDED

The problems which I have set forth touch many interests, both public and private. Their solution involves Federal and State legislation, and also involves co-operation between public agencies and the lumber industry. The different problems are closely interrelated one with another. Moreover, action in one section of the country concerns the interests of other regions. These circumstances make it clear that for a final solution there must be a far-reaching program that will enable the Federal Government, the States, communities, and the industrial forces to unite in a common effort.

Such a program should be comprehensive enough actually to accomplish the objectives sought by the public and essential to the permanent wellbeing of the industry. Many efforts have been made to find a solution for some industrial features or some public features of the forest and lumber problems, and have failed because they left out of account some outstanding question that must be solved at the same time. Let me illustrate:

REMEDIES HITHERTO PROPOSED INADEQUATE

It has been suggested that the problem of periodic over-production could be met by modifying the Sherman Act in a way to permit agree-

ments to curtail production when justified by industrial conditions. You will recall that this was proposed when the Clayton Act was under discussion; and in 1916 the proposal was put forward very specifically in a referendum from the U. S. Chamber of Commerce. It is out of place here to discuss in detail this proposal. There are, however, two defects that are pertinent to the present discussion.

This suggestion was offered to the country as a conservation measure. You will recall the language of the referendum, that "There should be remedial legislation to permit co-operative agreements under Federal supervision in those industries which involve primary natural resources, on condition that the agreements in fact tend to conserve the resources, to lessen accidents, and to promote the public interest." The report of the Chamber indicates that the question of handling the forests—that is, forest protection and forest production—is not a part of the plan. This means that the only conservation, so far as lumber is concerned, would be the saving of a measure of waste made possible through the more stable and advantageous trade conditions. The vital object of the public to secure a continuance of the forests is wholly left out of account.

A second serious defect is that it would not, in my opinion, be really effective in bringing about a condition of permanent stability. The forces that tend to throw an excess of lumber on the market are too strong. Lumbermen often say themselves that a lumber combination could not really exist because sooner or later some one would be unable to stand the pressure, and the usual break of market would occur. This is doubtless true, and applies also to such an arrangement as that contemplated in the proposed change of the Sherman Act.

In short, the proposal does not reach the real source of the difficulty and would not be of permanent benefit to the industry, aside from its failure to safeguard various general public interests.

A second suggestion that has been made is that the public co-operate in the conservative financing of timber holdings through long-term loans at low rates of interest. Some have suggested a system of forest loans backed by the public credit, similar to the loans made to farmers under the Farm Loan Act. The theory is that the financial strengthening of the stumpage holdings would act automatically to cause curtailment when the market is overloaded and prices are likely to fall. This proposal points directly to the greatest weakness of the industrial situation, but, like the previous plan, it is a half-way measure. It does not make any provision for the permanence of the forest.

Still again, tax reform has been urged for a decade or more. On the ground that the present system tends to force premature cutting, it is proposed that there should be an annual land tax and a tax on the product when it is cut. The present tax system without question operates to discourage the holding of land for growing timber. But there are other forces much stronger that are causing premature cutting and that are preventing the owners from caring for the cut-over lands. Taken alone, tax reforms will not achieve either result.

I can further illustrate the failure of half-way measures by reference to various proposals which have also been made regarding the protection and reproduction of the forest. Most of these concern fire protection, and largely leave out of account the question of forest replacement. Specific proposals, however, have been made to place legal restrictions on methods of operation in the woods. In a number of States such proposals have been widely discussed, bills have been offered in the legislatures, and there is behind them a very considerable body of public sentiment.

These have made little headway because for the most part they have not provided for meeting certain economic difficulties. Here again the industrial problems must be considered along with the proposals to secure forest renewal and growth.

In approaching the question of a national lumber and forest program, involving perhaps some radical departures from the present principles of relations between the public and industry, we shall find, I believe, that the most important and fundamental questions relate to the speculative character of forest ownership. Such ownership means cutting as fast as possible and without reference to how the land is left after lumbering. What is needed is some strengthening influence that would make possible the husbanding of the resource and its conservative use, as the public would use it if it had retained control over it, and at the same time provide for the continued productiveness of the land.

If the public had retained title to forest lands, it would have been able to dispose of timber as it is needed; it could have secured orderly development and built up permanent enterprises secure in a perpetual supply of raw material; it would have been able readily to organize protection and to secure forest replacement. The public cannot recover the position it surrendered, yet it may be possible to bring about in a measure the objectives we have been discussing.

WHAT AN ADEQUATE PROGRAM SHOULD INCLUDE

No single measure or action will meet all features of a lumber and forest problem. Each region will have a group of problems. Each region will require special consideration because of the peculiar local conditions. The required measures for the different regions, correlated for the whole nation, is the thing to be sought in the making of a national program. I can at this juncture only indicate what I believe should be the general objectives and the spirit of approach, and point a way to secure some definite action.

I am ready to advocate a policy more far-reaching in all respects than has generally been offered. I would afford whatever public assistance is needed to make possible the conservative handling of our forests, and I would then make fire protection, conservative production of lumber, and right methods of removal a matter of requirement, with such public direction and control as is necessary to realize the aims desired by the public.

Just what this action should be may vary in different regions. It may be a combination of several methods of public co-operation. It is possible that the principle of conservative financing with public co-operation may be applicable under some conditions. I would not hesitate to concur in such a principle provided it is a part of a plan that includes the accomplishment of the various public objectives of a broad forestry and lumber program. Circumstances will require a correlation of production with the economic needs of the country as one feature of a large program that guarantees the continuance of the forest. It should be under a system that makes the public a definite party to the undertaking and in a position to safeguard by direct action the various public interests.

Still again, in some localities the tariff, or local taxation, may play a large part in the industrial and forest situation. In such a case, I would meet these problems in the light of the needs of the permanent industrial life of the region, not of a group of industrial interests alone.

The adjustment of international relations, the reform of taxes, or other public measures taken to aid industry, should be considered in connection with the question of constructive handling of the timberlands. Already a number of lumbermen of the Northeast have stated to me that they would support a program that would make good forest practice a requirement, provided the public co-operated in removing the real obstacles now existing, and also provided that the

requirements which might be imposed were made applicable throughout the region without discrimination.

It is possible that where public and private lands are intermingled and ecnomically interrelated, as in the West, a still more far-reaching principle may be desirable—one that would co-ordinate all forest lands within economic groups so that they can be developed in a way best to meet the needs of the country and the communities. It has already been found necessary to co-ordinate and handle jointly all forest lands, regardless of ownership, with respect to protection from forest fires. A joining of hands of the public with industry in carrying out and administering the great private resources of timber so as to prevent the present waste and uneconomic over-production and at the same time to insure forest renewal is a distinct possibility. Under such a plan there would be public control of such features as concern the public welfare, and the industry would handle its part under conditions that would permit full play of individual initiative and enterprise. At the present time the mixed character of ownership tends to prevent an orderly development that builds up and sustains communities.

In all regions there is needed a broad policy of forest development, a policy which makes for permanent mills and all that means to the employment question, which places timber on the market only as it is needed, which protects the present resource—a difficult matter now, even under the most earnest efforts to co-operate—and which classifies the lands, encourages agriculture, puts to its best use every acre, and secures tree growth on non-agricultural lands.

Is not such an outlook worth while for the public? And is it not likely that the country would support such a plan if it could assure itself that the public benefits would be secured? Certainly it could afford to give its financial credit and authority, provided its interests are safeguarded by adequate control placed in public hands.

These are suggestions made to indicate the character of the co-operation the public might lend, and the sort of requirements it should exact. I have discussed a few of the principles, aims, and problems of a national policy. I have emphasized particular points because of their importance and because they are the ones most likely to cause difficulty. A national program should include many other features, such as Federal taxation, export problems, legislation and co-operation in fire protection, economic and technical research, etc.

One of the important problems is that of extending the public forests. There are many areas in our mountains which are so important from

the standpoint of protection of the slopes and of water resources that they should be owned by the public. Private owners cannot handle them properly, even under the most favorable conditions. There are also large areas of cut-over lands that would render their best service in public hands. Most of this land has been badly injured and is now carrying but little forest growth of potential value. The public should acquire large areas of such land and gradually restore it to productive use.

In view of the situation regarding cut-over non-agricultural lands and the steps that must be taken to restore them, I am in favor of a greatly enlarged program of acquisition on the part of the Federal Government and the States. The Federal Government has been acquiring cut-over and culled lands in the Southern Appalachians and White Mountains at the rate of about two million dollars per year since 1911, and the plan has worked out most successfully. Some of the States, too, are engaged upon programs of acquisition. New York State, with already a holding of nearly two million acres, has voted bonds for $7,500,000 to be expended for this class of lands. Cities also should undertake the acquisition of forest lands, especially those tributary to their city watersheds. This policy should be pursued until large areas of cut-over land, second-growth forest, and protective forest have been restored to public ownership. These publicly owned forests should be well distributed through all the forest regions. As these areas are acquired they should be organized as municipal, State, or National Forests.

EARLY ACTION URGENT

We may discuss these questions in meetings and conferences, and accomplish little. We have the problems to solve, and we cannot continue to ignore them. I regard the industrial problems as very urgent. Some action is inevitable in regard to the question of better forest protection, of forest renewal and growth after logging. Public demand for action is increasingly insistent. Now is the time, therefore, to bring about action in accordance with broad constructive plans, rather than by piecemeal legislation by different States, uncorrelated with each other and with action of the Federal Government.

I have taken it upon myself to ask for co-operation in laying the groundwork for a national policy. I have already initiated a series of conferences with forest agencies of the States and with representatives of interested institutions and organizations. I hope that the

lumbermen will concur in the need of such a movement as I am proposing, and will join in the undertaking to work out a constructive program. Specifically, I hope that there may be some official delegation of authority to representatives of the different branches of the industry to work with the Forest Service and other agencies in preparing a basis for the solution of our forest and lumber problems.

A PROGRAM OF FOREST CONSERVATION FOR THE SOUTH.[1]

By J. G. Peters

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The obstacles to the progress of forest conservation in the South are chiefly (1) the character of ownership of forest land, (2) the general lack of public sentiment for keeping this land productive, (3) the lack of funds in the State treasuries available for expenditure in forest conservation, and (4) the lack of co-operation in a broad way from the Federal Government.

Enormous areas which could not possibly be developed in a conservative, wise manner by the population available, were thrown open to the public as a result of the States and the Federal Government disposing of practically all of their lands in the South. Very naturally, economic conditions have made it impossible to develop or exploit any but the better lands; the poorer are left for a later day. Development has been in a large measure superficial and temporary, so that there are now in the South vast areas of waste land.

The Atlantic States portion of the Coastal Plain and the Piedmont are still, for the most part, divided up into rather large plantations. The owners are frequently land poor, but for traditional reasons are averse to parting with any of it. Stumpage only is sold and with little thought of a future crop. Still the timber is regarded as a part of the plantation; the owner is a permanent resident, as a rule, living either on the plantation or in a nearby town, who has some interest, however small that may be, in the conservation of the resources of his community. On the other hand, the timber of the Southern Appalachians and the Gulf States is held in fee, for the most part, by the lumbermen themselves, who in most instances are non-residents. These owners have little interest in the future of these regions and practically none in the continuity of the forests. With few exceptions, the lumbermen of the Gulf States estimate that present stands will run their mills for about 10 years. The policy of most of them when cut out will be either to sell out and get out or to wait for the home-seeker.

[1] Read before a meeting of the Washington Section of the Society of American Foresters, February 13, 1919.

The general lack of public sentiment for improving the situation is not astonishing. The South is still the center of lumber production of the country. The effect of the decrease in the supply of timber has scarcely begun to be felt, nor will it be until the center of production shifts to the Pacific Coast, with an accompanying heavy increase in the price of the product. Furthermore, damage to the forest from fire is scarcely recognized by the southern timber owner. The southern forests, unlike the northern, are not, as a rule, destroyed by fire. But the burning up of young growth, deterioration of the soil, effects of erosion, and other losses, enormous in the aggregate, are not generally given serious consideration. As for the actual practice of forestry, that, of course, amounts to almost nothing.

When the question of expending funds for forest conservation is put up to the southern legislatures, they generally have several objections to offer, particularly the lack of funds and the desire to pass the burden on to the land-owners themselves. Furthermore, the average southern legislator is an exceedingly practical politician, and many a worthy appropriation receives no attention because he can not have a say as to its disposition. The Southern States, though rich in natural resources, are financially poor, because of lack of development of these resources and a consequent small amount of active capital available for taxation. In consequence, by reason of their inability or reluctance to provide funds they often feel that if forest conservation is put into effect it should be paid for entirely by the owners concerned. There is often an utter lack of appreciation of the State's responsibility, of the large indirect benefits that would accrue to all of its people. The practical measure of the progress of forest conservation in the Southern States is shown by the present aggregate annual appropriation of so inadequate a sum as $60,000.

Each State must decide whether it wants to grow enough timber constantly to meet its own demand or whether it will be content to go outside, to the Pacific Coast most probably, and pay in addition to the cost of the lumber a tax in the form of freight rate. More important still is the question, shall the State allow large areas of waste land to remain idle and unproductive—shall the State allow its industrial prosperity thus to be checked?

Until the effect of high lumber prices makes itself felt, little if any impression is going to be made on public sentiment in the South by statements as to the amount of timber now standing and the probable rate of decrease in the future; as to what the lumber industry means to the South; as to the damage from forest fires and erosion; as to

the area of waste land and the increase in its extent, and the like, unless such statements can be backed up by evidence based on fact. We are not in possession of the facts; our statements are mere opinions. The only way we can obtain the facts is through survey and investigation. Funds to carry on such work on an extensive scale are urgently needed from both the States and the Federal Government. Until the State foresters of this region and the Federal foresters who have to do with it have something to show that can be relied on we shall continue to talk in glittering generalities, be considered as idealists, and not get very far because we are not taken seriously. It is high time for us to begin to consider a question of such importance on a practical, businesslike basis, and make a strong, combined effort to secure the necessary funds for such survey and investigation from our State and Federal governments. All the available data in the possession of the several States and the Federal Government, of which there must be considerable, should be brought together, and with these as a foundation a plan of action should be outlined which would be placed before the legislatures and the Congress. As a means of furthering this aim, so far as the Southern States are concerned, I suggest the formation of a committee composed of the several State Foresters, a representative from each State having no State Forester to be selected by the Agricultural College of the State, a representative from each lumber association, and three representatives from the U. S. Department of Agriculture, one each from the Forest Service, the Bureau of Soils, and the Bureau of Plant Industry; the representative from the Forest Service to act as secretary of the committee and its executive officer.

But what is to be done in the meantime? Although we do not have anything like the information we should, still we do know in a general way what the States and the Federal Government ought to do. This, it seems to me, should follow four lines: (1) Classification of lands, (2) Acquisition of cut-over and waste land, (3) Co-operation with private owners, and (4) Research. These are big public questions and involve large outlays of money. Therefore, they deserve very careful thought and consideration. The acquisition of land will eventually bring in a financial return; the State forestry department will, in consequence, be self-supporting, and will become, as it should, one of the most important of all the various State departments. Other activities will not show a direct return, but their indirect benefits to the State's general welfare will be large and valuable.

Land classification is an essential to any extensive and well-rounded policy of forest conservation—acquisition, reforestation, protection, taxation, and other activities. It is absolutely necessary for a working basis. Furthermore, we are not going to convince Congress and the legislatures that it is beneficial to the Government and the States to spend large sums for acquiring land, unless we can classify it and demonstrate to them in a practical fashion that the land we propose to purchase is the best for the purpose and is necessary to be held by the public for the general welfare. The same might be said of reforestation. Let me illustrate by an example. Recently at Concord, N. H., a conference of forest users and those interested in the development of forestry in that State was called for the special purpose of considering a reforestation policy. The feeling was pretty general that there was much waste land in the State, more particularly in the white-pine section, but just how much no one could say. On the other hand, the portable sawmill men felt that they could not keep up with the fast-growing young stuff. Therefore, a resolution was adopted requesting the legislature to provide a fund sufficient to enable the forestry commission to make a survey of the situation and to classify or determine the extent of the waste lands of the State so that the information could be used as a basis for a plan of reforestation. Fire protection, also, in some instances, will have to be worked out on a basis of land classification. Some areas we are going to have to burn, as for example, the longleaf pine lands where black-jack oak tends to come in heavily and keep out pine reproduction and forage grasses. An equitable system of forest taxation will depend absolutely on a classification of the land. Of course a detailed classification of land is not practicable at present, but much nevertheless can be done in the way of classifying forest growth and determining especially the quantity of standing timber and the amount of young growth on which to base estimates of future timber supplies.

Every one of the Southern States should have in time an extensive policy of forest land acquisition. Purchase would, of course, be confined to cut-over and waste lands. Obviously, on account of the enomous area of such lands and the limited funds available for the purpose, the beginning will be in a small way and progress will be slow. Some idea of the extent of the acquisition problem may be had from the estimate of the area of cut-over lands in Secretary Lane's report for 1918, which shows for the Southern States an aggregate of about 150,000,000 acres, or nearly 70 per cent of the estimate for the entire country. This figure might be the best guess that can be made, but it

is only a guess. As for the portion of this area which is waste land and should receive attention first no one knows its extent. It can be determined only through a classification. But even if it is as low as 5 or 10 per cent, it will be seen that the outlay required, at $5 an acre, will be from 38 to 75 million dollars. Of course no such appropriation for this purpose is going to be seriously considered at present by Congress and the southern legislatures. The Federal Government, itself the largest purchaser, has expended in eight years in acquiring less than one and three-quarter million acres only $11,000,000. Therefore, it is clear that no considerable progress in forest land acquisition can be expected for some time to come.

Along with the acquisition of lands, and co-ordinating with it, should go the co-operative work with private owners directed so as to offer substantial encouragement to the practice of forestry. The policy in co-operation should be distinctly to make the effort mutual.

The first co-operative activity would, of course, be protection from fire. The method of organization will vary with conditions in the several States. Thus in the mountains of West Virginia and, to a limited extent in North Carolina, the private owners are organized into protective associations supported by a levy on the lands represented. The State and the Federal Government co-operate with these associations and expend funds for the various protective needs. Virginia, in co-operation with the Government, directs its protective efforts primarily to the counties, and has met with really remarkable success in securing their active participation and financial aid. Kentucky, Texas, and Louisiana have, on account of very limited appropriations, adopted an extensive plan which is almost exclusively educational; patrolmen, some paid by the State and some by the Government, are given large districts of from 500,000 to 1,000,000 acres each, and they endeavor through propaganda to impress upon the public the need for keeping fire out of the woods. In Louisiana recently a unique protective organization was formed of timber owners, farmers, and stockmen, having in view not only the protection of the forest, but especially of crops and forage. If Florida, at the coming legislative session, authorizes a protective system it will probably be based on local option; the counties will be authorized to vote on whether or not they want protection from forest fires. These examples will give some idea of how the work may be done, in fact in a number of cases is being done though in a very limited and inadequate way.

After protection will come reforestation. This should consider

first the reclamation of waste lands. An excellent example of work of this character on a small scale is that done by Tennessee, where the forestry department co-operates with the owner to the extent of supplying the young trees at cost, supervising the planting, and keeping in touch with the work done through such inspections as might seem necessary. On the other hand, a State might merely supply the planting stock, either at cost or without charge except that of transportation. It would seem, however, that the best results may be looked for from a plan similar to that of Tennessee, by means of which the State would insure the success of the work by having its experts do it.

Working plans for the management of forest lands would also be included in any policy of co-operation.

These and other co-operative activities are going to require large expenditures if we are to get anywhere in forest conservation, bearing in mind that practically all of the forest land in the South is in private ownership. The question is to adopt the fairest and most practicable method of financing them. Until the growing of a forest crop becomes profitable it would seem that the private owner cannot be looked to to make the necessary expenditure to keep waste lands productive. Under present economic conditions it is difficult to see how else to secure the funds, in large part at least, than from public agencies such as the State, the county, the town, and the Federal Government. The private owner should, of course, be expected to share the cost. He should be enabled to obtain the money under easy terms through credit unions such as those recently organized in North Carolina, the Farm Loan Bank, and the like. It might be found necessary to enact legislation requiring him to contribute. A step in this direction has been made by Louisiana, which imposes a so-called severance tax on every thousand feet of timber cut in the State, which goes, in part, for the support of the forestry department. Special taxes of this character might be imposed from time to time, but it is probable that the State and the Federal Government will be the chief contributors for years to come. And why not? Both spend enormous sums keeping agricultural lands productive and securing improved methods of agriculture. Why not give forest lands and forestry relatively the same attention?

Either some co-operative plan will have to be worked out or regulations will be imposed, if the waste lands are to be kept productive. Such regulations might include for the higher mountains, at the headwaters of important streams, the designation of certain areas as pro-

tection forests where no cutting whatever would be permitted, and for the lower areas a system of cutting for continuous production to be prescribed by the State forestry department, an adequate system of protection from fire, the planting of certain areas, and such other requirements as might seem necessary.

Forest taxation at present is not a problem in the South. Eventually, however, the yield tax principle may be adopted, and if so, its application should be made obligatory, which would tend to prevent the shifting of taxes from the forest land to other property of the same owner.

Last, but really of first importance, is research. I say last, because it is not necessary to hold up the activities mentioned above until the results of research may be known. On the other hand, without research we can only reach a certain stage beyond which we shall be groping in the dark. The South offers practically a virgin field. It would seem that the States and the Federal Government should conduct the work on a co-operative basis, along some such lines as those suggested recently by Leavitt and Toumey. I agree with them that the Government should make a specific appropriation for forest research in co-operation with the States.

In this brief paper I have endeavored to give some idea of forest conditions in the Southern States, the obstacles to be overcome, and the activities which should be undertaken. I have not attempted, for lack of space, to go into the details which would be involved in putting the program into effect, the various methods of co-operation, and the like. The point to be borne in mind is, that since the States and the Federal Government in the first instance made the mistake of disposing of their lands to such an extent as to make it absolutely impossible for the small population of these States to develop adequately and use the land, and since as a result large areas are now lying unproductive, the States and the Federal Government have certainly some obligation in the matter, or at least until the owners can reasonably be expected to handle the land properly, and should at once endeavor jointly, with the owners, to remedy the harm done. The thought I wish particularly to leave with you is the hope that some day the Federal Government will recognize in a big way its obligation in helping to solve the forest problems of this region, as it is helping to solve the agricultural and road problems, by taking the lead and joining with the States and the private owners in a concerted effort to make and keep productive the enormous areas of waste land.

TROPICAL RECONNAISSANCE WITH SPECIAL REFERENCE TO WORK IN THE PHILIPPINES AND BRITISH NORTH BORNEO

By D. W. Matthews

Conservator of Forests, British North Borneo

Before any useful reconnaissance of any forest tract can be accomplished it is, of course, necessary that the forester undertaking it be acquainted with at least the principal species of commercial importance. In temperate regions, where the important species are few in number and where most of these are fairly well known, no extensive preliminary work is necessary before the reconnaissance proper can be taken in hand. Tropical forests, on the other hand, present the difficulty of great complexity of species combined with little or no silvical data regarding any but the most important species, and practical reconnaissance work has necessarily had to wait upon a vast amount of preliminary work leading to the identification and description of genera and species. But even these difficulties cannot account for the astonishingly small amount of accurate data which has been collected as to the volume stand of timber per acre in the tropics. The study and management of tropical forests is not a new thing. Definitely planned work has been going on, especially in India, ever since the middle of the last century, and vast amounts of data leading to the identification of genera and species and the habits of growth of the more important species have been collected, but the collection of any considerable amount of data as to volume stand per acre has lagged far behind this other work.

The reasons for this seem to be chiefly the following:

(1) The older tropical forest services have interested themselves chiefly with species of high commercial value and have especially studied only relatively small areas where these species form a fair percentage of the total stand; and

(2) Modern methods of logging, which call for heavy initial investment and complete utilization, are only just being established in the tropics.

The forest services of British India and the Netherlands East Indies have prepared working plans for special areas and as a basis for these plans have made detailed tree enumerations of the principal species

dealt with, but even for these special reserved areas no data are given as to total stand per acre. The Netherlands East Indies classify their forests as "teak forests" and "wild timber forests," and of the latter they say, in The Yearbook of the Netherlands East Indies for 1916:

"The outlying possessions, by which is understood all the islands of the archipelago except Java and Madura, have a total area of 180,000,000 hectares (690,000 square miles). According to a rough estimate, 50 per cent of this area is covered with wild timber forests which, as in Java, are composed of numerous varieties of trees intermingled one with the other. * * * The exploitation of the woods by private parties may only be done after a special forest concession has been obtained. Although a great number of requests for these concessions have been granted and private enterprise has increased considerably during recent years, very little importance must be attached to it.

As long as a country maintains this attitude toward one of its largest assets, it is not probable that we can expect any great development of this asset by private enterprise.

In the Philippines, with the advent of modern systems of lumbering, we have had the first attempt to obtain accurate estimates as to the stand per acre in tropical forests. This is the logical outcome of applying American systems of forestry and lumbering in the tropics. In the States we are accustomed to think of our forests in terms of so many thousands of board feet per acre, and when we came to deal with these new forests we at once started to gather data which would enable us to compare them with stands of timber with which we had previously been working. Furthermore, American systems of logging had developed along lines entirely different from those in use in other countries and the stand per acre bears a much closer relation to the cost of extraction in our systems of concentrated working than it does where the forest is worked by a system of small coupes distributed over a large area. Before the American lumberman could be induced to invest his money in the development of these forests, these data as to stand per acre had to be acquired, and thus we have had the beginning of volume estimates for tropical forests.

At first the work went forward very slowly. Administrative duties claimed a large portion of the time of the officers qualified to undertake the work and much preliminary data had to be acquired as to the extent and composition of a large and little-explored forest area. At first very little actual measurement of stands was attempted. It was necessary to cover a large area and estimation was based on ocular examination and comparison with stands of known density at home. Unfortunately this tendency to report on as large areas as possible

with the minimum of time and expense persisted even after the location of the most valuable and accessible tracts had been completed. Dr. F. W. Foxworthy, formerly Chief of the Division of Investigation, Bureau of Forestry, P. I., pointed this out in a report prepared during the latter part of 1916. In a summary at the end of his report he lists 26 detailed reconnaissance reports which were prepared by various officers of the Bureau between 1901 and 1916. These reports deal with a total of 3,473,748 acres and the estimates of stand are based on only 5,203 acres of valuation survey, or approximately 0.15 per cent of the area reported on. In only six instances were estimates based on over 1 per cent of the area prepared. It is not my intention to decry the usefulness of these reports. They have served their purpose and served it well, as the expansion of the lumber industry of the Philippines abundantly testifies. The data which appears in these reports and the knowledge of forest conditions which the writers acquired in their preparation have made possible the publication of the many valuable bulletins of the Philippine Bureau of Forestry which serve as the foundation for similar work elsewhere. They have also helped to make possible the general estimation of the timber resources of the tropics such as was given by Whitford in his article, "Tropical Forests and the War," which appeared in the May, 1918, number of this JOURNAL.

But data such as the above must be considered as only the foundation for the acquisition of more detailed and accurate data. Whitford's estimate of 6,150 billions of board feet as the standing timber of the tropics is of great value from a broad economic standpoint. It shows us what we can eventually expect to draw from the tropics and conversely gives a lead toward the conservation of our home supplies. We have satisfied ourselves that the tropics contain vast supplies of merchantable timber, but this is only the beginning of the work. The utilization of this wealth is a vastly larger problem and it cannot be proceeded with until accurate data as to many accessible forest tracts are at hand. No investor can be induced to undertake the promotion of a lumber company in the tropics upon the mere assurance that the total stand runs into the thousands of billions of feet. His interest will be awakened, perhaps, but he will desire definite facts and figures and these data can only be obtained by intensive reconnaissance. The time for extensive hasty examination only is passed, and if the work which has already been done is to achieve its purpose we must proceed with more detailed and costly surveys.

The wide utilization of the less rare tropical timbers will be slow in coming, but a start has been made and both the Philippines and Borneo have been successful in placing their "ordinary timbers" on outside markets. British North Borneo has been exporting construction timbers as well as the rare hardwoods ever since 1881, and just prior to the war was achieving considerable success in placing the softer but well-colored woods on markets in the United Kingdom and Australia. In 1913 the Government of British North Borneo decided that their forest resource was an asset which merited attention, and early in 1915 a definite program of forest exploration was inaugurated. By the end of that year the work had proceeded far enough to indicate that the timber supplies of the State were one of its principal assets, and in 1916 the Forestry Department was definitely organized as a permanent government institution and the work of exploring and classifying the timbered areas of the State and administering the development of the resource entrusted to it.

North Borneo lies directly south of the Philippine Archipelago and at no great distance from the islands of Mindanao and Palawan. As is to be expected from its geographical location, the forest is very similar in character to that of the Philippines, and although some species, such as Billian (*Eusideroxylon zwageri*) and Borneo camphor (*Dryobalanops* spp.), are found in abundance in Borneo, but only rarely or not at all in the Philippines, the bulk of the important species are closely related to or identical with those of the Philippines. This fortunate circumstance has enabled reconnaissance work in Borneo to proceed with a rapidity and accuracy which would not have been possible had not the experience and data gathered in the Philippines been available as a basis to start from.

As the work in Borneo has so recently started, the forest staff is small, consisting of two American foresters and three trained Philippine rangers. Provision has been made for the enlargement of the staff, but as yet it has been impossible to obtain the men. The area of the State of North Borneo is approximately 31,000 square miles and the total forested area is at present estimated to be 19,000,000 acres, of which probably 13,000,000 acres carry commercial forest. With a forest area as vast as this to deal with, it was clearly impossible to aim at any accurate estimation or classification of the timbered area as a whole. It was therefore decided to run intensive surveys at points where the forest was accessible from harbors or navigable rivers, and where the timber seemed to be at least as good as the average. It was hoped that work such as this would lead immediately to the location

of at least some areas carrying stands heavy enough to warrant development on a large scale. The detailed data thus acquired would then be of immediate use when such areas were opened up, and, although there were was the possibility of running unnecessarily detailed surveys in areas which would eventually turn out to carry too low a stand to make the area commercially valuable, this policy has been adequately justified by results. The work has now been under way four years and, excluding explorations which have been of a preliminary character, fifteen detailed surveys have been completed. Of these, twelve have resulted in the location of commrecial stands easily accessible from navigable rivers or harbors, the great bulk of the timber lying within five miles of tide water. The total area covered by these twelve surveys is 185,136 acres and the total estimated stand of timber 333,889,000 cubic feet. The estimate has been based on 5,420 acres of valuation survey, or 2.92 per cent of the area covered by the surveys, and the average stand per acre works out at 1,803 cubic feet. The close relation of Bornean forests to those of the Philippines is shown by the following comparative table, which gives the stand per acre and percentages for the important Borneo species and for identical, or closely related, species in the Philippines:

Species.	Stand per acre in Borneo, cubic feet.	Per cent.	Stand per acre in Philippines, cubic feet.	Per cent.
Seriah (*Shorea* spp.)	554	30.73	490	20.50
Kruin (*Dipterocarpus* spp.) .	265	14.70	471	19.72
Uratimata (*Parashorea* spp.)	189	10.38	413	17.30
Selangan batu (*Shorea*, *Hopea*, and *Isoptera* spp.)	114	6.38	73	3.06
Kapor (*Dryobalanops* spp.) .	109	6.05	not represented	
Selangan kacha (*Shorea* spp.)	72	4.00	66	2.77
Billian (*Eusideroxylon zwageri*)	72	4.00	not represented	
Mengaris (*Koompassia excelsa*)	70	3.89	rare	
Identified species of commercial value not occurring in large quantities...	158	8.77	446	18.65
Unidentified miscellaneous species	200	11.10	430	18.00
Total	1,803	100.00	2,389	100.00

The Philippine data for the above table were compiled from Foxworthy's résumé of reconnaissance work done in the Philippines, two pieces of work covering 2,225,000 acres being excluded because the

percentage of the area covered was too small to be reliable, being less than 0.038 per cent. The Philippine figures are drawn from work covering 1,248,832 acres and based on 4,365.62 acres of valuation survey, or 0.35 per cent of the area. The Bornean figures refer to 185,-136 acres only, based on 5,420 acres, or a 2.92 per cent survey.

An interesting fact brought out by the above comparison is that the five timbers of the family Dipterocarpaceæ, which occur in quantity in both countries, make up 62.59 per cent of the stand in Borneo and 63.35 per cent of the stand in the Philippines. Of these five timbers all except selangan batu (*Philippine yacal*) are relatively soft woods. Tanguile (*Shorea polysperma*) occurs in the Philippines in much greater abundance than in Borneo and kapor (*Dryobalanops* spp.) is not represented in the Philippines. Both of these are softwoods.[1] Adding the percentage figures for these two timbers and excluding selangan batu, we find that in the Philippines 67.29 per cent of the total stand is composed of timbers which are relatively softwoods, suitable for general construction purposes and interior finish, while in Borneo 62.36 per cent are of similar character, if not identical. The lower percentage of softwoods for Borneo is due to the fact that billian, the Borneo ironwood, occurs in quantity and that selangan batu is more abundant in Borneo than in the Philippines. Otherwise, from the commercial standpoint, the close relation of the forest in these two regions is remarkable.

As to total stand, the figures thus far at hand indicate a heavier stand per acre in the Philippines than in Borneo. I am not inclined to think that this is the case. Philippine figures are based chiefly on the sample-plot method, plots being located in typical areas and then a guess made as to the total area to which any plot or series of plots could be referred. In any work such as this the unconscious tendency is to locate plots in areas which are a little better than the average. As it was possible to work on a much more intensive scale in Borneo, the strip method has been used in every case and the results could, therefore, be applied directly to the whole area under consideration. With this method there is much less likelihood of overestimation. On the other hand, the results thus obtained cannot safely be used as a basis for estimating the total stand of timber except in the coastal belt,

[1] The word "softwood" as applied to tropical timbers is only relative. Kapor and kruin would probably not be considered softwoods in extra-tropical forests. They are neither as soft or as light as the seriahs, but when compared with dense and heavy woods such as billian and selangan batu the term "softwood" can be legitimately applied.

where practically all of the work has been done. The vast interior of the State is still, from a forest standpoint, unexplored. However, as the development of the interior must wait upon that of the more accessible areas, there seems little present need for an attempt to determine the total stand. With the data so far gathered it would be impossible to make a complete comparison as to total stand in the Philippines and Borneo, but as most of the work that has been done in the Philippines has been in areas which it was hoped would be later developed, the figures given above may be of use as indicating the relation between commercially accessible forest areas in the two countries. It is certain that these two regions, and probable that all Malaysia, contain large accessible areas carrying stands of timber so closely related in character as to permit it to be marketed under a few trade names and dense enough to warrant large capitalization and intensive logging methods. Much more detailed reconnaissance work is required before even a small percentage of this vast potential supply can be realized, but it is apparent that the development of tropical forests is on the eve of a vast extension, and Whitford's prediction that "* * * some tropical regions will become practically independent of foreign supplies and will be furnishing their next-door neighbors * * * " is in a fair way of realization.

RESULTS OF CUTTING AT NE-HA-SA-NE PARK, IN THE ADIRONDACKS [1]

By B. A. Chandler

Assistant Professor of Forest Utilization, Cornell University

This study of the results of old cuttings on spruce growth and reproduction grew out of the sample-plot work which the sample-plot committee of the New York Section of the Society of American Foresters[2] undertook last year in co-operation with Cornell University. The work was conducted on the holdings of the Ne-ha-sa-ne Park Association at the invitation of its superintendent and forester, F. A. Gaylord. This park is the private hunting and fishing resort of Dr. W. S. Webb and was cut over fór spruce some fifteen to twenty years ago, according to a general plan of management laid down by the present United States Forester, Col. Henry S. Graves.[3]

The purpose of this study was to determine the practical results of this system of management.

The data were collected this past summer by the strip-survey method, combined with growth studies of individual trees where cutting was in progress. The study was confined to the hardwood type, because it is there that the most difficult problems of spruce management are found. Two areas were studied: one lying southeast of the southerly portion of Rock Lake and bounded by the lake, its outlet, and the southwest line of the park. The other lay north of said lake and between the inlet to Beaver Dam Pond and the westerly edge of a spruce cutting which was in progress. Ten per cent of each area was covered by strips, making 21.5 acres actually calipered on the first area and 15 acres on the second.

In the field-work I was assisted by H. W. Maier and others. J. A. Dimock assisted in the computation and preparation of the manuscript. F. A. Gaylord generously assisted in the expense of carrying on this work.

Graves' object, as stated in his own words, was "to obtain for the owner a large revenue from the timber, but at the same time leave the

[1] Paper delivered before the New York Section of the Society of American Foresters, at Albany, January 22, 1919.
[2] See Journal of Forestry, Vol. XVI, No. 8, pp. 922-927, December, 1918.
[3] Graves, Henry S.: Practical Forestry in the Adirondacks, U. S. Forest Service, Bull. 26, 1899.

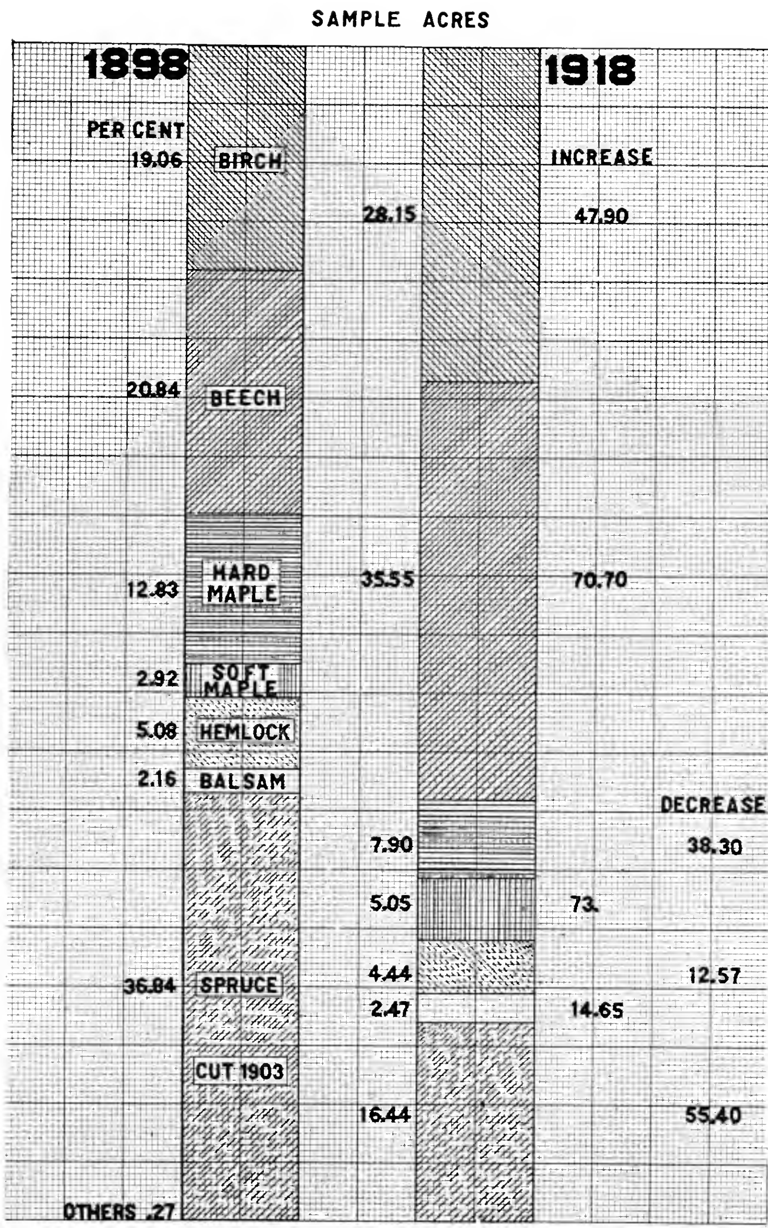
SAMPLE ACRES
1898
1918
PER CENT
19.06
BIRCH
INCREASE
28.15
47.90
20.84
BEECH
12.83
HARD MAPLE
35.55
70.70
2.92
SOFT MAPLE
5.08
HEMLOCK
2.16
BALSAM
DECREASE
7.90
38.30
5.05
73.
4.44
12.57
36.84
SPRUCE
2.47
14.65
CUT 1903
16.44
55.40
OTHERS .27

Fig. 1.

forest in a condition to produce a second crop in a short time, and to reseed the openings made in the lumbering with young growth of valuable species." Undoubtedly the spruce cut fifteen years ago provided for the owner "a large revenue from the timber." The "second cut" to which Graves referred is our present stand of spruce ten inches and over in diameter breast high.

THE PRESENT STAND

Within the limits of error caused by slight possible differences of opinion as to what constitutes the hardwood type and the inherent in-

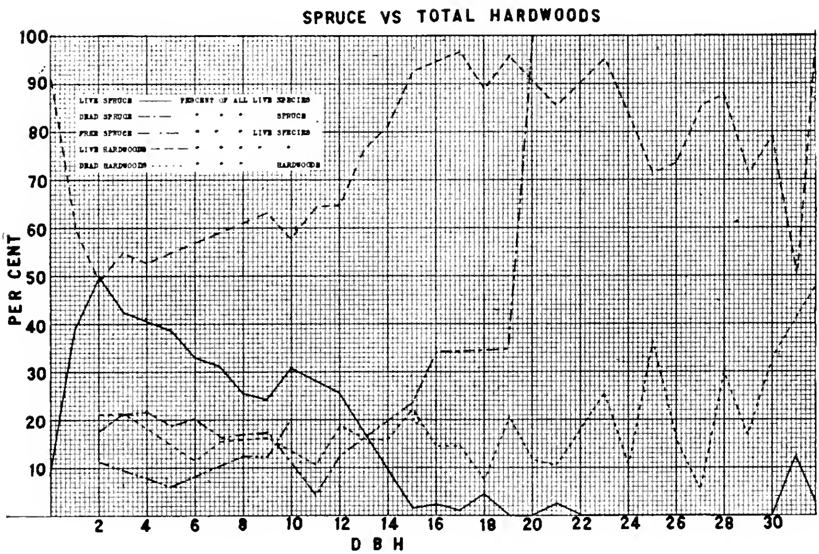

FIG. 2.

accuracies of the strip-survey method, the present sample acre may be compared with that of 1898.

Figure 1 shows that in 1898 the sample acre of the hardwood type for trees ten inches and over in diameter contained 36.8 per cent of spruce. Today only 16.4 per cent of these trees are spruce. This means a decrease of 55.4 per cent in spruce and a corresponding increase of 70.7 per cent in beech and of 47.9 per cent in yellow birch.

This 16.4 per cent of spruce, representing 930 board feet, cannot be compared with the yield predicted by Graves because his "yield" tables

were not classified by types. However, the data regarding the rate of growth and mortality of spruce, given below, make it difficult to see how this yield from the present stand can be as great as predicted.

THE PROSPECTS FOR THE NEXT CUT

The prospects for the next cut, or third cut, of spruce are not encouraging. The hardwoods are fast dominating the stands. As figure 2 shows, in the two-inch class both areas have about 50 per cent of spruce and of hardwoods. From two to ten inches the per cent of hardwoods is almost uniformly greater than that of spruce. Above ten inches the per cent of hardwoods increases rapidly and in the higher diameter classes the hardwoods are completely dominant. Not only are there more hardwoods than spruce in practically every diameter class, but the inevitable decrease in number with increase in diameter is less rapid for the hardwoods than for the spruce.

On the first area in the two-inch class there are 25.8 spruce and 25.5 hardwoods, or practically an equal number of each. In the ten-inch class the hardwoods are nearly double the spruce, for there are 8.0 hardwoods and 4.3 spruce per average acre.

This numerical decrease is not necessarily due to mortality. However, above ten inches the rapid increase in the per cent of hardwoods shows that there is no mortality among the hardwoods comparable to the decrease caused by the axe in the spruce.

A comparison of the number of hardwoods and spruce which have died, apparently since the last cut, also indicates a greater mortality among the spruce (see figure 2).

Since the number of hardwood trees above ten inches has greatly increased since 1898; since the hardwoods are dominating practically all diameter classes in the present stand, and since the death rate of the spruce is apparently greater than that of the hardwoods, the young spruce growing up from the lower diameters have, evidently, a hopeless fight against an overtopping mass of large hardwoods. The condition of the spruce, moreover, makes the situation even more hopeless.

CONDITION OF THE SPRUCE

On the first area over 60 per cent of the spruce below seven inches are suppressed. This per cent drops, due probably to the death of a large number of the suppressed trees, to 29.2 per cent at ten inches. On the second area the per cent of suppressed trees runs a little higher.

The question as to whether these suppressed trees can recover is a

debatable one. Howe[4] suggests that there may be such a thing as "inherent dominants" among spruce. Due to the numerical dominance of the hardwoods, few of the suppressed spruce will get the chance to

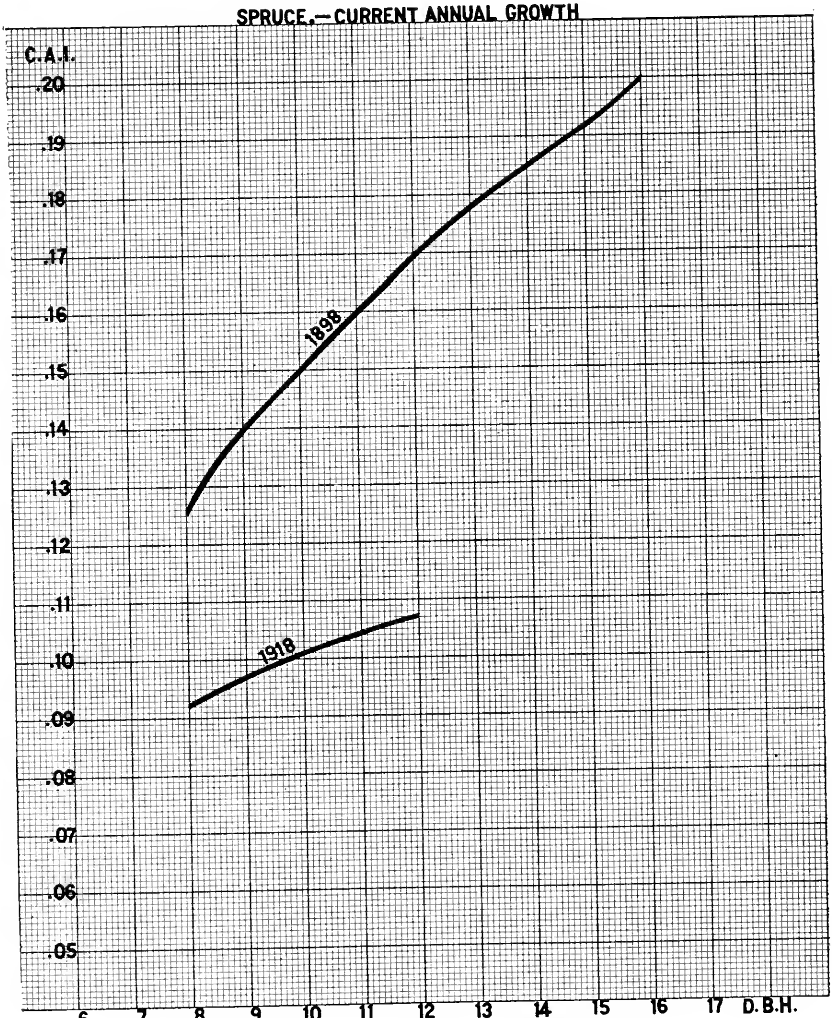

FIG. 3.

recover. That not all of them have the ability to recover is evidenced

[4] Howe, C. D.: Forest Regeneration on Certain Cut-over Pulpwood Lands in Quebec. Ninth Annual Report of the Commission of Conservation of Canada, 1918.

by two conditions observed while taking growth data in connection with this study. Several spruce suppressed by trees cut fifteen years ago had not recovered, in spite of the fact that they had had plenty of room ever since. Also several spruce, although seemingly freed by the same cutting, actually showed a retarded growth. On the other hand, the surrounding hardwoods showed an accelerated growth. In these cases the hardwoods had taken very good advantage of the openings made by the cutting and are presumably responsible for the retarded growth of the spruce.

To what extent spruce growth has been retarded by situations of this kind cannot be determined without more study. The fact that the average current annual diameter breast high growth curve obtained from this study is considerably lower than that obtained by Graves indicates that spruce growth may have been considerably decreased by the acceleration of the hardwoods (see figure 3).

Since the suppressed spruce has little chance of making even a good fight, the real struggle lies between the free spruce and the total hardwoods. The unevenness of the fight may be seen by comparing the curve representing the per cent of free spruce of all live species with the per cent of hardwoods of all live species (see figure 2). Because of this overpowering domination of the hardwoods over the free spruce, the prospects for large future cuts of spruce seem to be very poor.

SPRUCE REPRODUCTION

The conditions which have been observed are not favorable for the development of spruce seedlings if present silvicultural ideas along this line are correct. Even if a large percentage of the seedlings were spruce, only a few of them could hope to mature. However, only 12.8 per cent of the seedlings on the second area and only 8 per cent on the first area are spruce. Thus spruce seems to be doomed to a continually decreasing position in the stand.

A LOOK FORWARD TO 1934

Data are not available for accurate predictions about the condition of these areas fifteen years hence. It seems evident, however, that after any cutting of spruce the remaining spruce and other species make a competitive fight for the space thus left in the forest. Assuming that the sample acres for 1898 and 1918 are comparable, and that the competing species will divide among themselves the space left by the cutting

of 1919 in the same relative proportions into which they divided that of 1903, only 7.3 per cent of the stand above ten inches will then be spruce.

This is probably a conservative estimate, for it seems evident that the fighting ability of the spruce has been greatly diminished since the past cut. But aside from the above assumption, the data would indicate that it will not take very many cuts of spruce on the diameter-limit basis to eliminate spruce as a commercial species from these areas.

PRACTICAL SUGGESTIONS

In applying data of this kind, collected on restricted areas, one must be careful not to apply the conclusions too generally. Therefore the term "hardwood lands" in the discussion of the practical application of these data should be understood as referring only to hardwood land where conditions exist similar to those observed on these two areas.

These data indicate that hardwood lands when managed for spruce require more intensive methods.

The first step in this direction is to "scrap" the diameter-limit idea. The diseased spruce—spruce which will not be freed by the cutting and spruce which have been so badly suppressed that they probably will not recover—should be cut to the lowest possible size. As much of the hardwoods should be cut as the market conditions will permit. As many small and medium, well topped, free spruce should be left as lumbering conditions and the danger from windfall will allow. In other words, the timber should be marked by a man who knows all that is known about the silviculture of this type of forest and who at the same time knows the market conditions with which he is contending.

It should be kept in mind, however, that these are only temporary measures, and that possibly no satisfactory system of managing hardwood land for spruce can be found short of clear cutting and planting as put into practice by Fernow at Axton.[5] Most companies are now getting their supply of spruce from remote areas. It would not be good business policy for these concerns to plant these remote areas before all those near at hand had first been reforested. It therefore follows that a company may be practicing the best of forestry if it disregards for the time being spruce growth and reproduction on its far-away lands, provided, however, that in lieu of the outlying districts it replants those lands within easy distance of its mill. Systematically pur-

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[5] Silviculture at Axton and in the Adirondacks Generally, by R. C. Bryant, Journal of Forestry, Vol. XV, No. 7, pp. 891-895, November, 1917.

sued, this will provide future crops which can be harvested with the least possible cost.[6] It may even be necessary, in order to develop a market for hardwood, and thus make possible the clearing of land for planting purposes, that spruce concerns become hardwood operators.[7]

CONCLUSION

The conclusion to be drawn from these investigations is strongly suggestive that the expectations of the Forester will not be realized on these areas at Ne-ha-sa-ne Park.

The hardwoods have taken advantage of the openings; they have reseeded themselves in large numbers; the crowns of the older trees have already spread out over the unused spaces, and the spruce factor is dwindling with each cut. Every time that a conifer is removed, further advantage is given the hardwoods, for they are left in possession of the field. The young spruce which is expected to restock the forest meets more and more opposition. Apparently only the free class can be depended upon to fight its way through to maturity.

The young spruce has to bear the competition of its own species; it has to meet the hardwoods, as seedlings, as saplings, and, finally, as a complete canopy over the whole area, for the hardwood trees of the big-diameter classes will soon make a complete cover.

At every stage of its life the young spruce is compelled to meet overwhelming odds, and if by a miracle it happens to reach the ten-inch class there awaits it the forester with his axe!

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[6] Chandler, B. A.: Are We Willing to Pay the Price? *New York Forestry*, Vol. V, No. 1, April, 1918.

[7] The Laurentide Paper Co., Ltd., Grand Mere, Quebec, is beginning to develop a policy similar to this.

OBSERVATIONS ON UNBURNED CUT-OVER LANDS IN THE ADIRONDACKS[1]

By E. F. McCarthy

Professor of Forest Utilization, New York State College of Forestry

The following observations were made during the summer of 1917 in carrying out investigative work planned for that year under the direction of The New York State College of Forestry, Syracuse, N. Y.

The fundamental assumption which led to this method of silvicultural investigation is that all immediate problems of reproduction which can be worked out upon sample plots can now be observed on cut-over lands in the Adirondacks, providing the history of the stands can be determined with certainty.

INFLUENCE OF TYPE

It soon became obvious that a clear distinction of type in the Adirondacks is essential to any silvicultural investigation, and that this type distinction must be much sharper than that employed in previous studies on virgin timberland.

In going over the literature it was found that no particular effort had been made to segregate types in the preparation of stand tables for prediction of yield; that the studies of type made by Pinchot and Graves had formed the basis of practically all investigations. In spite of the thoroughness of the work done, the stand table upon which future yield was predicted below 10 inches d. b. h. was constructed without reference to type, one stand table representing all types on the area. There resulted from this method of prediction of future yield an exaggerated representation of softwoods on the hardwood type in diameter classes below 10 inches. This is necessarily true because of the larger number of small diameter softwood trees found on swamp acres and upper slope acres than that found within the hardwood type. The definitions of type used herein follow the plan prescribed by the original Bulletin 26[2] study and retain the same names and gen-

[1] Delivered before the New York Section of the Society of American Foresters, at Albany, N. Y., January 22, 1919.

[2] Graves, Henry S.: Practical Forestry in the Adirondacks. U. S. Forest Service, Bul. 26, 1899.

eral characteristics. The types recognized are: (1) swamp, (2) spruce, flat or lower slope, (3) hardwood, and (4) upper slope. It becomes necessary for any further silvical studies to draw the lines of boundary quite sharply and any studies undertaken by the New York section of the Society of American Foresters should make the delineation of type boundaries its first task.

The edge of the swamp type is marked by the disappearance of the spongy forest floor and establishment of deeper drainage. Birch and soft maple found in the next higher type also mark the edge. The upper boundary of the spruce flat type was drawn where balsam begins to disappear from the stand and where beech enters. The upper boundary of the hardwood type was accepted as defined by the study of Township 40[3] with the qualification that small areas of typical upper slope forests are found on ledges appearing within the hardwood type. Where these areas are sufficiently large, they should be eliminated.

THE MANAGEMENT OF THE SWAMP AND SPRUCE FLAT TYPES.

Only a brief statement will be made with regard to this. The result of studies, some data on which are presented in "Production of Pulp on Balsam Lands,"[4] makes it obvious that we may expect a future crop of softwoods upon the two lower types within a comparatively short rotation following present cutting, because of the excellent reproduction that occurs on swamps, and the comparatively good softwood reproduction that occurs on flats. It will probably be necessary to remove from the balsam flat type the larger hardwoods, and cutting will probably reduce the area of the balsam flat type by favoring the encroachment of hardwoods, especially yellow birch, from the hardwood lands toward the swamp.

HARDWOOD TYPE

Lumbermen and foresters are willing to admit that the chief problem of management of the Adirondack forest is centered in the hardwood type and the data herein presented have to do largely with this type. It has been observed by lumbermen that the hardwoods are inclined to dominate the forest after the cutting of softwoods to a diameter limit. It is a mistake for foresters to assume that the study made on Nehasane Park has not influenced logging in the Adirondacks, because

[3] Hosmer, R. S., and Bruce, E. S.: A Forest Working Plan for Township 40. U. S. Forest Service, Bul. 30, 1901.
[4] Paper, Vol. XXIII, No. 7, October 23, 1918, pp. 14-18.

private lumber companies have given this diameter limit method of cutting a very thorough trial with the intention of maintaining softwood production upon their lands. Many of these private companies have since gone over their lands the second time and picked up the windfallen spruce and continued the cut down to the merchantable limit for pulp because of the heavy loss from windfall. The only motive which seems to have actuated pulp operators to give up the diameter method of cutting has been the damage from windfall, which cannot be denied, especially on exposed situations. Sufficient time has now elapsed since the first cutting by the diameter-limit method to answer the questions presented as to the silvicultural feasibility of this method of management of the Adirondack forest.

ACCELERATED GROWTH OF SPRUCE

I wish to present data taken from an area which had been cut to a diameter limit 20 years previous to the study on the Brandreth Estate immediately south of Nehasane Park, and to make the statement before presenting figures that in my judgment the hardwood crown has closed over the spruce trees remaining after the first cut so quickly as to have made their recovery brief and to have added very little extra volume to even the larger diameter classes and almost none to the lower. An examination of the data presented will show plainly that the increase in rate of growth after the first lumbering operation was not greatly in excess of what might be expected from the virgin stand untouched. The crown cover of the forest shows every evidence of complete closure in the lapse of 20 years after the first logging operation to a 12-inch diameter limit.

The following facts may be deduced from Table 1 and figure 1.

1. Diameter growth on the stump shows practically no acceleration over the normal rate of growth even in the first ten years and less in the second, especially in the 8-inch class.

(Attention is called to p. 445 of U. S. Forest Service Bulletin 26, which shows acceleration in diameter growth greater at the stump than at the top of the first log.)

2. Mean height growth was least in the tallest trees and shows a falling off in the lower two classes.

3. Eight-inch trees are 167 years old, with no visible means of shortening this period materially under the shade of hardwoods.

In the matter of volume of second cutting, it is true that a comparatively good cut has been obtained after a lapse of 20 years, but this

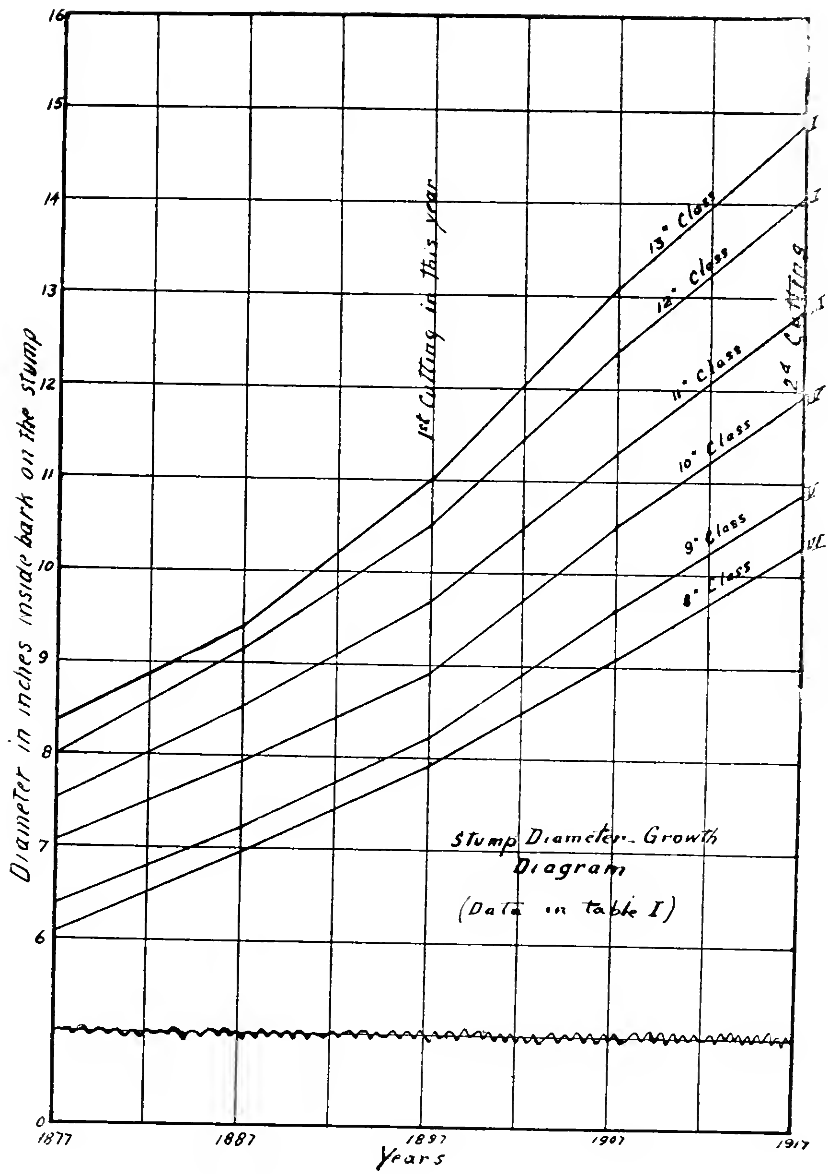
16
15
14
13
12
11
10
9
8
7
6
0
Diameter in inches inside bark on the stump
1877
1887
1897
1907
1917
Years
1st Cutting in this year
2d Cutting
13" Class
12" Class
11" Class
10" Class
9" Class
8" Class
I
II
III
IV
V
VI
Stump Diameter-Growth
Diagram
(Data in table I)

FIG. 1.

was increased by the addition of softwoods as follows: Swamps which were not previously cut were cut this time; hemlock which was not previously cut was cut this time; the present cutting of spruce was extended to a 10-inch diameter limit on the stump one foot from the ground, where previous cutting had only reached 12 inches breast-high. These three sources would have made a considerable cut immediately following or preceding lumbering operation and must not be confused with increment during the lapsed period of 20 years.

STAND AND REPRODUCTION

General data on stand and reproduction are included, as taken and averaged for two areas. The first area was selected from the extreme southern part of St. Lawrence County, and represents a type of lumbering which gave no thought to future production, while the second area is a portion of the Whitney estate on which a plan of forest management was put into operation twenty years ago, with the purpose of securing successive cuts of pulp.

A caliper record was made for each area, taking the trees down to the two-inch class (that is, down to 1½ inches), breast-high, on ten per cent of the total area. In addition to the caliper record, reproduction counts were made on three sample plots per acre, established at regular intervals. These plots were 1 rod square and marked on the boundaries by a 66-foot tape with pins fixed at 16½-foot intervals. All reproduction that had produced branches and was less than 1½ inches in diameter at breast-height was counted. Mortality of the younger seedlings was considered too high to give results of value.

The column marked "Cull" in the hardwood caliper record includes all mature trees that would not be worth cutting now and all trees of less than merchantable sizes, which because of decay or crook give no promise of production of marketable timber in the future. The areas selected are fairly representative of the natural type as modified by the logging operations. Whether or not they are average for the type throughout the Adirondack region, certain facts may be pointed out which will keep their relative importance regardless of the variations in the composition of the type.

From the study of the area selected from the Whitney estate, where the spruce was cut to a diameter limit of 10 inches in 1898 the following deductions are made:

1. The crown cover of the hardwoods has become re-established during the twenty years that have elapsed since the cutting.

TABLE 1.—*Totals of Classes*

(Classed according to d. b. h., inside bark)

Peeled red spruce measurements gathered on the Brandreth tract August 7-17, 1917. 313 trees. Shannon's Camp, Brandreth, N. Y. Cut over for softwood 20 years ago. Showing increase of growth during that time.

D. B. H., inside bark.	Stump height, in inches.	Diameter class.	Number of trees.	Total height, feet.	Merchantable length, plus stump.	Age at stump.	Diameter of first five decades in from bark, inches on stump.					Non-merchantable top.				
							0	10	20	30	40	Radius in inches.	Age, in years.	Length of top, feet.	Mean annual height growth, feet.	Mean annual increment diameter, inches.
7.99	11.9	8	57	55.9	46.5	167	10.26	9.06	7.90	6.94	6.06	1.63	25.3	9.4	.37	.131
8.92	13.3	9	91	59.5	48.7	170	10.86	9.61	8.20	7.21	6.37	1.65	24.8	10.8	.435	.133
9.73	14.6	10	80	63.05	51.7	181	11.92	10.50	8.90	7.94	7.08	1.7	24.8	11.35	.46	.137
10.83	15.5	11	48	67.02	55.4	189	12.84	11.30	9.66	8.52	7.50	1.70	25.7	12.62	.49	.132
11.86	15.6	12	29	67.0	56.6	195	14.08	12.40	10.50	9.14	8.00	1.69	28.2	10.04	.36	.120
12.8	17.2	13	8	69.7	60.5	199	14.84	13.08	10.98	9.38	8.38	2.50	26.8	9.2	.344	.196
			313													

2. There is not a sufficient representation of softwoods in each of the diameter classes to produce successive crops of softwood within reasonable intervals, while the proportion of softwood in the stand is being decreased by each successive softwood logging operation.

3. There is no evident increase in softwood reproduction due to logging.

4. The reproduction table (table 4, column 1) shows a preponderance of beech and sugar maple (shade-enduring species), but the fact that a like increase does not show in the 2-inch class after twenty years is evidence that these are already suppressed.

5. The small number of yellow birch and the absence of black cherry in the reproduction is evidence of the crown density of the mature stand, and a noteworthy index of the future character of the forest.

On the area logged for both hardwoods and softwoods *ten years* ago the following facts are shown by the study:

1. All species were cut to a lower diameter than on the Whitney estate with the crown cover remaining open ten years after the logging.

2. The representation of the softwoods of all diameter classes is here less able than on the other area to maintain successive cuts of softwoods within reasonable intervals.

3. There is evidence of increase of spruce reproduction and of increased rate of growth since the logging, as is shown by the increase in numbers in the 2-inch diameter class.

4. There is also an evident increase in the number of hardwood trees in the 2-inch diameter class, especially yellow birch, the most prolific and rapid-growing of the hardwoods.

5. The preponderance of yellow birch in the hardwood reproduction and decrease of the more tolerant species, with the occurrence of black and fire cherry are the result of the open character of the stand. The chief significance of this heavy stand of rapid-growing hardwoods is the good average height growth (about ten feet for birch) which has been made since the cutting, and the straight clean growth. Birch and black cherry have established themselves in the lead and will dominate the stand.

RECOVERY OF SMALL SPRUCE AFTER SUPPRESSION

For the purpose of comparison of this rapid growth of hardwoods there is submitted a height growth diagram of red spruce based on 316

trees taken from the area logged for both hardwood and softwood. All these trees have had top light since the logging operation, except as interfered with by hardwood seedlings which have started since the logging. The trees made no recovery from suppression for the first three years but at the end of seven years are growing at the rate of .79 feet per year. It is shown that two-foot trees recover more quickly and grow faster than ten-foot trees. (See fig. 2.)

SUMMARY

Either method of logging increases the percentage of hardwood. Logging to a diameter limit, while it leaves the woods clean, and comparatively free from fire risk after a decade, makes no progress toward future softwood production, or the disposal of the poor grade of hardwoods which are taking space and making no timber growth of value.

Any heavy cutting of hardwoods will make a large amount of slash, increasing the fire risk until the crown cover has become dense enough to retain the moisture, and decay the slash. In the meantime a good growth of hardwood saplings will start on every area of this type if the woods are opened sufficiently, and fires are kept out. Freedom from overhead interference will cause a straight growth of hardwood saplings and produce a stand of hardwood much superior to that found in the original forest.

Softwood trees, released by heavy cutting of hardwoods, will mature more quickly than under the shade of a diameter-limit cutting, but the slow growth and late recovery of spruce will necessitate subsequent cuttings of hardwoods before the spruce will make a free growth.

If the production of a large percentage of softwood in mixture with hardwoods is to be the purpose of management of this type in the Adirondack forest, then the destruction of the bulk of the hardwood crown cover is essential. Whatever the ultimate method used to produce as large a number of softwoods per acre as possible, it must not be overlooked that a dense crown of hardwoods will damage severely the young hardwoods which succeed in starting, and that this type is primarily a hardwood type, and will for several rotations remain so in spite of all efforts short of cutting clean, burning, and planting. It is as much the purpose of management to produce good specimens of hardwoods in the mixture as to produce the largest possible percentage of softwood.

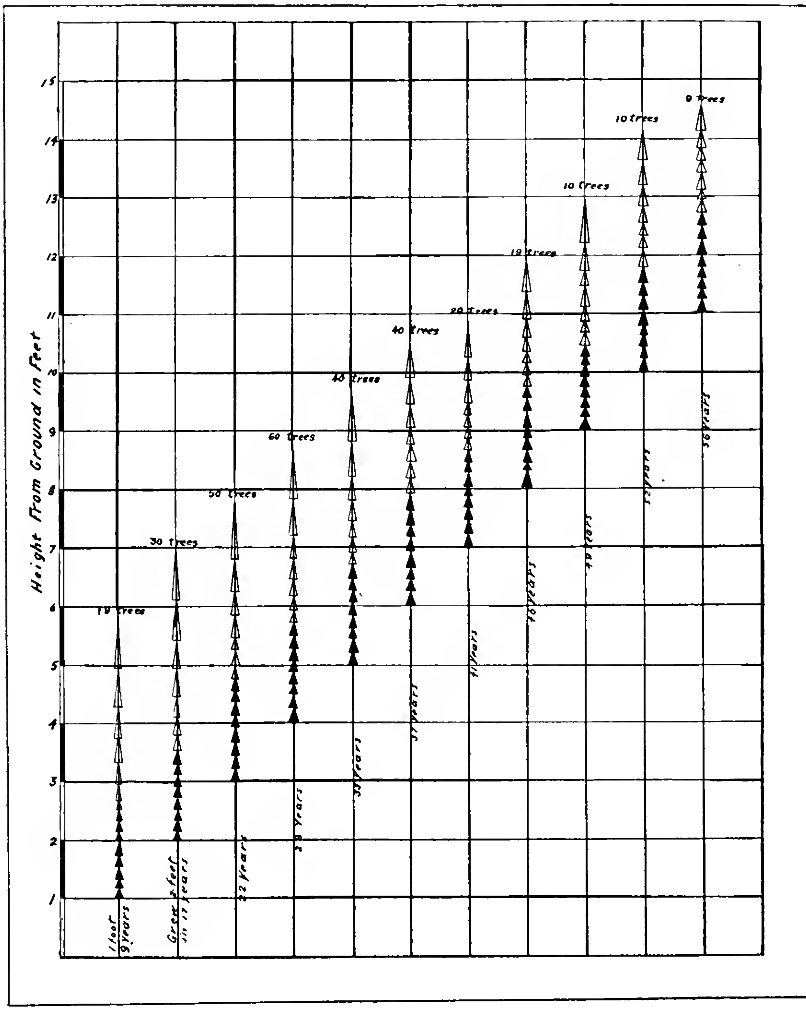

Fig. 2.

Fig. 2.—Diagram showing the current annual height growth of red spruce for the past 15 years previous to 1917. Logged for both hardwood and softwood in 1910. Arranged by height classes according to height 15 years ago.

TABLE 2.—*Stand Table*

Mixed hardwood and softwood slope type

Cut over for all merchantable timber. Southeast ¼, township 15, Macombs Gt. tract number 3 (Southern St. Lawrence County). Number of trees per acre by species (average 68 acres).

D. b. h. classes (inches).	Spruce.	Hemlock.	Balsam.	Maple.		Beech.		Yellow birch.		Black cherry.
				Sound.	Cull.	Sound.	Cull.	Sound.	Cull.	
2	23.6	.19	.07	22.6	.71	16.1	1.1	47.8	.7	2.3
3	8.6	.2	.1	.....	....	.....	.....	.....	....	....
4	9.7	.4	.1	1.7	.35	8.5	2.3	4.8	.8	.5
5	4.5	.2	.08	.....	....	.....	.....	.....	....	....
6	4.5	.3	.1	1.1	.62	4.5	1.5	2.5	.8	.03
7	2.0	.1	.06	.....	....	.....	.....	.....	....	....
8	2.6	.09	.04	1.1	.61	2.8	1.8	1.8	.6	....
9	.6	.03	.00	.....	....	.....	.....	.....	....	....
10	.9	.04	.01	1.0	.75	2.07	1.3	1.1	.6	....
11	.25	.00	...	.....	....	.....	.....	.....	....	....
12	.2	.01	...	.8	.57	1.1	1.4	.5	.5	....
13	.1	....	...	.....	....	.....	.....	.....	....	....
14	.02	....	...	.25	.35	.43	.6	.2	.2	....
16	.....	....	...	.1	.5	.07	.1	.07	.1	....
18	.....	....	...	.1	.02	.01	.15	.04	.1	....
20	.....	....	...	.05	.02	.04	.12	.00	.07	....
22	.....	....	...	.....	.08	.....	.03	.00	.1	....
24	.....	....	...	.....	.05	.....	.07	.06	.07	....
26	.....	....	...	.02	.03	.....	.00	.06	.00	....
28	.....	....	...	.....	....	.....	.03	.03	.04	....
30	.....	....	...	.....	....	.....	.....	.....	.04	....
32	.....	....	...	.....	....	.....	.....	.....	.02	....
Total	57.57	1.56	.56	28.82	4.66	35.62	10.50	58.96	4.74	2.83

TABLE 3.—*Stand Table*—Mixed hardwood and softwood slope type. Cut over for softwood to 10-inch diameter limit in spruce. Not logged for hardwood. Northwest ¼, township 35, Totten and Crossfield purchase. From the north slope of Niggerhead Mt. Whitney estate. Number of trees per acre by species. (Average of 37 acres.)

D. b. h. classes (inches).	Spruce.	Hemlock.	Balsam.	Beech.		Maple.		Yellow birch.		Black cherry
				Sound.	Cull.	Sound.	Cull.	Sound.	Cull.	
2	12.15	1.19	1.35	15.00	1.27	2.59	.24	2.81	.38	.03
3	10.15	1.97	.62	11.51	1.81	1.53	.27	2.68	.54	.03
4	8.76	1.11	.81	8.32	1.48	1.65	.27	2.54	.22	.14
5	5.57	1.13	.92	6.06	1.43	1.08	.11	1.59	.30	.00
6	4.76	1.08	.97	5.04	1.19	1.18	.16	1.10	.16	.00
7	4.46	1.11	.38	3.89	.59	1.05	.16	1.35	.27	.03
8	3.86	.98	.49	4.03	.73	1.32	.19	1.10	.08	.00
9	2.79	.95	.54	3.37	.67	1.58	.16	1.08	.14	.03
10	2.40	.65	.40	2.54	.84	1.46	.08	.92	.08	...
11	1.56	.70	.49	2.54	.51	1.22	.13	.70	.14	.03
12	1.05	.73	.35	2.16	.59	1.81	.05	.81	.27	...
13	.60	.51	.19	1.54	.51	1.78	.11	.73	.08	.03
14	.16	.60	.16	1.62	.35	1.38	.08	.75	.08	...
15	.11	.40	.03	.97	.44	1.13	.14	1.05	.08	.03
16	.11	.22	.03	1.19	.44	1.11	.03	.84	.05	...
17	.05	.30	....	.73	.21	1.11	.05	.62	.22	...
18	.03	.22	....	.78	.13	1.07	.....	.59	.08	...
19	.....	.11	....	.48	.05	.76	.....	.54	.14	...
20	.....	.27	....	.40	.08	.49	.....	.54	.11	...
21	.....	.08	....	.30	.08	.54	.....	.46	.05	...
22	.....	.16	....	.08	.11	.35	.....	.24	.15	...
23	.....	.16	....	.03	.05	.30	.....	.32	.08	...
24	.....	.03	....	.05	.00	.27	.....	.35	.00	...
25	.....	.08	....	.03	.00	.19	.....	.30	.03	...
26	.....	.03	....	.00	.00	.13	.....	.27	.08	...
27	.....	.05	....	.03	.03	.05	.....	.16	.05	...
28 to 35 inclusive	.....	.08	....	.....	....	.17	.....	.54	.11	...
Total	58.57	14.43	7.73	27.30	2.23	72.66	13.59	24.97	3.99	.35

TABLE 4.—*Showing the Number of Seedlings and Trees Less Than 1.5 Inches in Diameter at Breast Height, per Acre, by Species*

Species	Number per acre: Logged to diameter limit	Number per acre: All merchantable timber logged
Pine	0	0
Hemlock	13	2
Spruce	185	454
Balsam	21.4	13
Beech	1,036	578
Sugar maple	3,779	838
Red maple	793	900
Yellow birch	224	2,530
Black cherry	0	36
Fire cherry	0	404
Totals	5,051.4	5,755

Column number 1 taken from 97 sample plots distributed over 37 acres in northwest ¼, township 35, Totten and Crossfield purchase. This, a portion of the Whitney estate, represents hardwood and softwood type which was logged to a 10-inch diameter limit, as discussed in F. S. Bul. 26, in 1898.

Column number 2 taken from 181 sample plots distributed over 680 acres in the southeast ¼, township 15, Macombs Great Tract number 3 (Southern St. Lawrence County). Represents same natural type of mixed hard and softwood, logged for both hard and softwood without diameter limit, about 1907.

FOREST SERVICE SALARIES AND THE FUTURE OF THE NATIONAL FORESTS

By Aldo Leopold

Secretary, Chamber of Commerce, Albuquerque, N. Mex.

During the past five years there has been a cumulative realization of the fact that the low scale of salaries paid by the Forest Service was causing a shortage of competent men on the National Forests. The cost of living has so far outstripped the almost negligible promotions allowed by Congress that there has been an increasing annual exodus of leadership, experience, and ability—technical and non-technical—into other fields.

This fact is so well known as to require no further proof or mention. The purpose of this paper is to point out two facts which I believe have so far been realized only dimly, if at all, by the profession: First, that the salary situation threatens the ultimate success of our great experiment in national forestry; second, that really logical methods of redress have not yet been attempted.

As to the first point, I believe that foresters and the proponents of forestry have somewhat deceived themselves as to the real status of the National Forest system in the eye and mind of the voting public. We are repeatedly assured that the Forest Service has won a firm position in the minds of the people. This is true. But has national forestry likewise permanently established itself? Is the public convinced that forest management of the timbered public domain, by technical foresters, is a permanent and indispensable function of the Federal Government? I believe the answer cannot be quite so positively affirmative. In the West there is good reason to believe that public support attaches itself not so much to national forestry as to national foresters, and to certain incidental services, such as range control and the infusion of civic leadership into isolated communities, which these foresters have rendered with notable efficiency. In other words, the public has approved, not so much the great cause, but rather the efficient organization.

Now, if we allow low salaries to kill the efficiency of the organization, what will happen? *The alienation of local public support.* And with State control and the machinations of politicians even now constantly

hovering in the background, it is not at all improbable that the overthrow of the whole system might follow.

Grant, however, for the sake of argument, that so far all is lovely, and that the public, local and general, is at this time thoroughly determined that the National Forests are a permanent institution. How long will this determination endure? How long, for instance, will the cattleman in his super-six acquiesce in the decisions of a ranger who does not command the salary of the least of his straw-bosses? How long will the timber operator abide by the judgment of the sale officer whom he can command at will by making him his employee? Just so long as such rangers and sale officers are big men who stick to small salaries through a love of the work or a spirit of service. But carry the process beyond the sticking point, and replace them by small men who accept small salaries because they can command no other, and you have a radically different condition and one which the forest-using public will not long endure. Instead of small salaries evoking a premium of additional respect, you pass very suddenly to the very opposite effect.

There is much evidence to prove that the Forest Service is at this moment passing the critical point where big men find it not only unprofitable, but even impossible, to hang on any longer. It would be idle to hope that the able men returning from military service will avert the crisis, because they will no more than suffice to replace unqualified men taken on during their absence. We arrive, therefore, at the end of the same old circle—the point impending demoralization, the consequent alienation of public support, and the possible undermining of the whole structure.

I assume it is unnecessary to argue that the collapse of the great experiment in national forestry would have widespread effect. State forestry, private forestry, forest schools, the profession in general, and even other fields of conservation would be profoundly affected. The writer contends, therefore, that the Forest Service salary question is a menace to the whole forestry movement in America. Its solution is a matter that should interest every forester and every good citizen interested in the conservation of natural resources.

Now, the foregoing prognostications, correct or incorrect, are of little consequence unless they suggest a prompt and practicable remedy for the existing evil. I believe that they do suggest such a remedy. But first let us inquire what remedies have been already tried, and find out why they have failed.

Redress in the past has been sought by furnishing Congress with

statistics showing the increasing losses of good men, the rising cost of living, and the need of retaining good men to discharge the administrative functions of the service. In other words, Congress has been given logic. But, speaking by and large, Congress does not in such matters respond to logic alone. Congress responds to pressure. The number of perfectly logical needs brought before Congress is infinite. Only those needs backed by an organized public opinion can hope for adequate congressional action.

Now, right here we have at once the cause of past failure and the hope of future success—*organized public opinion.* The public is the place for our logic. Congress is the place for resulting public pressure. And, after all, this is as it should be.

As long as we presented Forest Service salaries as a departmental question, the public was not interested. After all, what is one Government department, more or less? But make it a question of the success or failure of the great cause of national forestry, and you have something to talk about. Few western foresters realize the number of influential citizens—especially in the East and Middle West—who are ready to respond instantly to such an appeal.

To make a long story short, the Forest Service should present its logic to the American Forestry Association, and to those numerous smaller organizations of various kinds which reach the "conservationist" public. The Forest Service should stress not the plight of the department but the plight of forestry. And the whole profession should join in advertising the danger. Results in Congress will follow.

I am aware, of course, of the regulation on political activity—the multitude of sins of commission which it prevents and the multitude of sins of omission which it is sometimes called upon to condone. But this may be dismissed as trivial and irrelevant. We can make our appeal if we set about it with tact and determination.

I am also aware that all the requisite facilities of organization to reach the conservationist public may not be at hand. For this fact foresters may blame only themselves. We have been inclined to smile a little indulgently at the people who "love trees," who sometimes excessively admire our "wild, free life in the woods," and who now and then confuse our high calling with that of the tree doctors, the purveyors of hardy flowering shrubs, and other useful pursuits. But after all, we now and again will need these people, and they are highly intelligent and responsive people. Therefore, let any necessary facilities of organization be created forthwith with our support. And in

passing let us thank the far-sighted few of our profession who have kept alive, by dint of hard personal effort, the "forestry movement."

But the foregoing is only one of the practicable channels for redress in the salary question. The other lies to hand, and may be used at once by Forest Service men. I refer to the personal influence of large permittees, to whom a stable and efficient field force is a matter of plain self-protection.

In other words, let the supervisor who enjoys the personal confidence of the large stockman make it plain that the way for him to avoid the hazards of dealing with a new ranger every few months is to get his Senator interested in a living wage for rangers in general. The idea is probably obvious without further explanation. Its limitations are also obvious. If not used with discretion, and impersonally, it is better let alone.

A third method of redress, which is already well under way, and which merits mention here, is the organization of Federal employees unions. These unions are noteworthy in that they disavow the strike as their weapon, and especially in that they aim to stimulate better service at the same time as they claim better pay. In so far as they adhere to this spirit, and in so far as they stress the need for promotions rather than blanket raises, they may safely be considered as an invaluable instrument for progress, meriting the personal support of every forester in the Federal service.

INFLUENCES OF THE NATIONAL FORESTS IN THE SOUTHERN APPALACHIANS.

By William L. Hall

Assistant Forester, U. S. Forest Service

When into a region long and thickly settled an unusual system of ownership is projected which sets up new aims, causes rearrangement of the population and reorganization of the industries, it is important to observe closely the results to see to what extent they are beneficial. This kind of a change has occurred in the Southern Appalachians. Into this region, thickly populated and long occupied under individual ownership and used for agriculture, was projected a plan of national ownership which has forestry for its purpose and which effected change of title and of use to more than a million acres of land, causing a complete rearrangement of communities and material readjustments of industries. In such a transition it is important for those interested in forestry to observe and interpret the results as soon as they become apparent.

It should not escape attention that widespread changes were occurring in the Southern Appalachian region before the Government began to transform large parts of it into National Forests. The Southern Appalachian region is thickly settled. It is reported by one authority to be as thickly settled as the Blue Grass Section of Kentucky and twice as thickly settled as the State of Iowa.[1] In all probability, however, its population is no greater today than 30 years ago, and so far as certain localities are concerned the population today is less than one-fourth what it was 30 years ago.

What has happened is that a redistribution of population has taken place. Thirty years ago families were scattered all through the mountains, each family occupying a small farm, from 60 to 95 per cent of which was covered by timber. Each family subsisted on what could be produced on the few acres of cleared land, pieced out by fish and game. There were no good roads, frequently no roads at all, and no opportunity to reach outside markets with farm products except those which could be carried on horseback or on foot. In the transition that has ensued, irrespective of Government ownership, the population

[1] J. H. Arnold: Farmer's Bulletin 905, U. S. Department of Agriculture.

has to a large extent been drawn out of the remote and inaccessible sections of the mountains and concentrated along the lower coves and valleys where roads have been built and where industries dependent upon forest products have developed. Towns and villages have grown up and some of the valleys now have railroads. The influence which chiefly has operated to bring about this result has been the assembling of the small mountain farms into large timber tracts. The mountain farmer sold his tract, including both forest and farmland, to the timber company and went down the cove to work in the sawmill, on the railroad, or in some other industry which has entered the region.

A change of this sort should not be objected to by any one. It has brought industries into the region, made money plentiful, given opportunity for employment. It has made it possible for the people to live in towns or villages where they can have roads, schools, and churches, where they can mingle together in social affairs and maintain intercourse with the outside world.

The establishment of a million and a quarter acres of National Forests has for one thing simply made more complete this industrial and social transition. There are, however, certain additional results of Government ownership which we may well observe. The time is too short as yet to measure the full effect of the changes which are taking place as result of the Government ownership, but already we may note some of them. They merely indicate the more extensive results which may be expected if the same transition in ownership occurs widely in this region. These results so far as they concern the lands which are purchased are bold and outstanding when the conditions are contrasted with the conditions obtaining on private lands. Less distinct, but still easily discerned, are the influences of Government ownership which extend beyond the lands actually acquired to the lands still in private ownership and to other communities of the general region.

We may group under four heads the influences at present discernable, as follows: (1) on local population, (2) on local improvements, (3) on local industries which use wood as a material, and, (4) on forest management, not only on the lands themselves but upon the larger region of which they form a part.

In considering first the influence of Government ownership on the local population we note in some localities, as already indicated, a decrease in population due to the acquisition of lands occupied by mountain farmers. In many instances farmers take the money paid them for their lands and go elsewhere and buy farms or else become

employees in some industrial establishment. In cases where large tracts are acquired from lumber or timber companies this reduction in population has to a large extent already taken place.

Some of the mountain farm sites vacated are not again occupied. Sometimes tumble-down shanties and cabins are demolished to prevent occupation, because the site is unfavorable for a home. In other instances the houses are reoccupied, or the farmer-owner himself remains, but the occupancy from the time the Government acquires title is upon a different basis. In the course of the movement by which the Government acquires title to an entire locality or watershed it is readily seen that quite a complete local change may be effected.

After the land is acquired by the Government and as the new Forests are organized and developed there sets in a tendency for population to increase, but upon a basis different from the old one. Men are required to build improvements, to aid in protecting and administering the lands. They must live on or near the Forests and they must have homes. Their dependence now is not entirely upon what they can produce on the little mountain farms. It is only in part, sometimes in small part, from that source. Another source of income is the revenue they receive as employees of the Government. This may not be large, but it helps the family to live and helps the localities where there are a good many such families.

The acquisition of this land by the Government gives many opportunities for making small timber sales. Small sales suit the Government better than big ones and many of these local people become buyers of Government timber, sometimes in a very small way. Numerous sales are made for less than $100. Before Government ownership was in effect there was no opportunity for small timber operators. The only feasible operations were those requiring heavy investment of capital and operated upon large tracts. Under Government ownership and administration small sales are the normal, natural development and they suit the local people. Upon the new industrial basis these people have the prospect of steady incomes from their labors, the chance to become independent operators and to make a real business success if they have any ability.

With this situation, improved standards of living are coming in. Homes are kept in better repair. Painted houses and touches of home adornment are to be observed. Money is available for better food and clothing. The life is different. The people are different. Yet it must be remembered that these are the genuine Appalachian mountaineers who, until a few years ago, had no outlet for their products and none

for their energies except the manufacture of moonshine liquor and the maintenance of community feuds.

Next is the matter of local improvements. It would seem that we should first consider road building, but until now we have done so little road building, because of the lack of funds, that the good results which might be expected if roads could be built have not been realized. When the Government began purchases in the Southern Appalachians I know of only two well-located and well-constructed mountain roads. One was the well-known Yonalossee road between Linville and Blowing Rock, N. C., the other was the Vanderbilt private road up Mt. Pisgah. Few roads have been built by the Forest Service, but considerable aid and encouragement has been given to road building and much road repair work has been done. I believe it fair to say that the situation with respect to roads is better on the Forests now than it would have been had these lands remained in private hands.

When we consider trails and telephones we note a complete change. Whereas the mountains were practically inaccessible before, they are now penetrated by hundreds of miles of well-graded trails which can safely be negotiated by any one at all used to mountain travel. Telephone construction has been pushed to such an extent that phones are almost as common in and around the new forests as they are in the better-developed sections of the country. With the direction one may get from local people, especially from local forest officers, with telephones available for keeping in touch with the outside world, with the trails fairly well equipped with sign-boards, one may travel on foot or horseback to many sections of inspiring mountain scenery which were entirely inaccessible before.

Another thing which the Forest Service has fostered and aided wherever possible, although we could not put funds into it, is the improvement of school houses. All of these improvements fit in with the reorganized communities of which I have already tried to give a picture. They play an important part in community development and well-being just as they do in the protection and use of the Government lands.

Before leaving this subject of the local influences of the Forest I should not fail to note the fact that in acquiring these lands at first there is a loss to the counties in taxes. This, however, is overcome as soon as business sets up on the Forests in a moderate degree, because the local counties participate in the returns from these lands in the same proportion as counties elsewhere participate in the returns from the National Forests.

Under my third head, that of influence on the industries, I can say that the going industries which require wood as a raw material are unquestionably finding Government ownership advantageous to their interests. The conditions of the Forest silviculturally is such that it is desirable almost everywhere to do some cutting. Consequently the Government has manifested its purpose of making sales of timber in all localities where there is need for it and where there is a market for the products. Therefore, the Forest, the local industries, and the local people are all benefited by carrying on continuous timber operations. To the industries is thus guaranteed a steady and permanent supply in volume such as can be permanently maintained or increased. There is promise of satisfactory increase in the productiveness of these forest lands. Lands which six or seven years ago gave little promise of furnishing much forest growth for years in the future have, under fire protection, already produced a vigorous oncoming growth of young trees which has surpassed the expectations of the most optimistic of us. On the other hand, the improved market conditions now enable us to take from the woods much material that had no value ten or even five years ago. Hence the industries are getting much more material than we figured would be available for them, while at the same time improvement cuttings and a general cleaning up of the forest are possible to an extent beyond our expectations.

Another influence is discernable, namely, the influence of these publicly owned lands on private lands. First, let us consider the matter of fire protection. It is directly due, in my judgment, to the presence of Government lands under systematic fire protection in northern Georgia that a system of protection has been put into effect on large private holdings which cover with the Government lands more than 75 per cent of the mountain section of northern Georgia. This accomplishment has been brought about without any forestry law or any systematic efforts on the part of the State of Georgia to promote fire protection. In States like North Carolina, Virginia, and West Virginia, where there are State foresters and systematic efforts at fire-protection, the Government lands have been the most effective centers for organizing the fire-protection work. The experience of the Government on its own lands has been invaluable and the aid of the representatives of the Government has been greater than the aid secured from any other source.

When we turn to the subject of conservative cutting on timberlands the influences are less tangible. In one instance the holder of extensive timberlands in western North Carolina adopted completely the Gov-

ernment's plan of cutting in making sales of his timber to private operators. This was done with the view of maintaining the land in such condition as to make it more acceptable to the Government as an addition to the National Forests. This land has now passed to the control of the Government. On the other hand, we have to note that in most of the larger timber operations in the Southern Appalachians, there has been no change in former methods of cutting except to make the cutting heavier as result of higher lumber prices.

Whatever influence there has been in the direction of conservative cutting has been exerted chiefly in the direction of the owner of the small tracts which lie near the National Forests. These owners are in a position to observe the methods employed by the Government and to note their advantages. I am of the opinion that this influence is considerable and my expectation is that it will grow as the conditions on the National Forests improve. In this way will the Forests serve as demonstration areas, the influence of which will widen with time.

Before closing my discussion of this subject, may I suggest that an organization distributed as the National Forest organization is distributed through the Southern Appalachians will become an almost invaluable aid in case of any movement on the part of the public to exercise further control of private Forests, because the foresters have studied closely the silvicultural conditions of the Southern Appalachians, the conditions as respects timber trade and operations. They would know how to go about a plan of regulating private cutting because they have some knowledge of the silvicultural problems involved and they are acquainted with the people.

Lastly, let me say a word in appreciation of the accomplishments of the technical forester in working out the administration of these National Forests. At the start we placed technically trained foresters in charge of all the Government-owned lands in the Appalachians. That policy has been strictly adhered to and the results have amply justified it. These men have had to work in the most remote and unknown parts of the Appalachians. They have been the agents by which a completely reversed social and business system has been put into effect. They have accomplished this result not only, but in doing it they have become the trusted leaders of the local people, the men of vision whom the local people now regard as among their best friends and to whom very generally they are willing to give their utmost aid and co-operation. In my judgment the Government's accomplishment in this undertaking has been increased at least a hundred per cent by this policy.

FORESTRY AND THE WAR IN ITALY.

By Nelson Courtlandt Brown

U. S. Trade Commissioner

In spite of the severe handicaps of an exceedingly small percentage of forest area, the impoverished condition of its forests, due to overcutting, burning, and overgrazing, and the lack of sufficient funds, Italy has made distinct progress in her forestry program.

In arriving at a proper estimate and view of the Italian forest situation one must perforce look at the situation in retrospect. The political and economic background of the past centuries' history is the explanation for the present condition of Italy with respect to her forests. Although old historically, Italy is young politically, and has only been a unified nation since the year 1870. Before that date the Italian peninsula, to a large extent, had been successively dominated during the Middle Ages by Spain, France, and Austria, and had been split up into a large number of small states and kingdoms. Among these were developed local differences and jealousies which tended to disintegrate rather than consolidate the nation. Before 1870 the history of Italy is a long series of wars and internal dissensions which have drained the economic strength of the country.

It is believed that the present war, although severely straining its economic resources, has greatly unified and strengthened the nation. It has given Italy a new sense of national spirit and of unity and independence which she has heretofore lacked to a large degree.

Italy, furthermore, has been greatly handicapped in her industrial development by the lack of the two basic materials of industrial progress, coal and iron. The secret of her industrial future lies in the development of her various water-power properties, and she has already contributed through engineering and electrical genius what she has lacked in natural resources. With respect to water power, Italy is unusually well favored, since it is very mountainous and it has a very heavy rainfall, particularly in the north. The region of the Italian Alps, with its southern versant, is of impermeable granite, the streams are unusually steep, and the rainflow exceedingly abundant. Various estimates of Italy's water power are from 4,000,000 to a maximum of 8,000,000 horse-power. According to recent figures

compiled for the Ministry of Agriculture at Rome, there are 5,000,000 horse-power. Of this amount 24 per cent of the total available horse-power has been utilized. In the percentage of water-power utilization, Italy exceeded only by the United States, Switzerland, and Germany, and exceeds such other important water-power countries as Norway, Sweden, England, France and Canada in its percentage of used power. In respect to developed horse-power per square mile of area, Italy is exceeded only by Switzerland among the other important countries. Water-power development began in 1892 with the use of the famous falls of Tivoli near Rome. The largest plant at the present time, at Valcomonica, delivers 20,000 horse-power a distance of 72 miles, and the plant at Tirano transmits 20,000 horse-power a distance of 25 miles to Milan. By royal decree of November 26, 1916, a plan was promulgated for much more complete utilization of Italian hydraulic energy. It is estimated that by the further development of 1,000,000 horse-power a saving in annual importation of 3,500,000 tons of coal will be effected, resulting in a change of at least $20,000,000 in Italy's trade balance.

Italy's forest program is obviously closely associated with her water-power interests. In the Italian Royal Forestry College, special attention is given to the training of men in the development of water-power properties, the effect of forests on run off and stream flow, water storage, construction of power dams and the utilization of hydro-electrical energy. Many of Italy's most prominent water-power properties are in the region of the Alps along the battle front. Over 1,000,000 acres of forest land have been destroyed in this section either by shell fire or by cuttings for military purposes. This condition will have an important bearing upon stream flow and consequently upon the utilization of available water power, and is a problem which must be faced in the immediate future.

Forestry began in Italy in 1869 with the establishment of a nucleus of her state forests such as the forest of Ficuzza in Sicily, the forest of Vallombrosa in Tuscany, and the founding of the Forestry Institute at the monastery of Vallombrosa. Forestry in Italy is largely nationalized and the great focus of interest revolves about the central governmental control. Although there is an active forestry association similar to the American Forestry Association in this country, and the Italians are generally great lovers of the forests and the outdoor life, little has been done in the way of forestry in Italy aside from government activity. Some of the municipalities have well-managed forests, but as a rule the private companies and individuals who own

and control 43 per cent of Italy's forests have done little in the way of scientific management with them. The centralization of interest as well as the central control of education are entirely in the hands of the Italian Forest Service at Rome, under the Ministry of Agriculture, which controls both the Royal Forestry College and the two Ranger Schools. Great reforms were initiated in the forest laws of 1910, 1912, and 1913, when the appropriations were raised from $300,000 annually to about $1,000,000.

The war has now given Italian forestry a most serious setback, which is appreciated by no one more keenly than the Italian forestry officials themselves. Italy is normally a country of large importation of forest products, amounting in the rough to about 1,000,000 board feet annually before the war. Its forest area of only 17.64 per cent of the entire country has suffered heavily during the war. The situation may be summarized as follows:

1. The normal importation of forest products has been heavily diminished for a period of over four years.

2. There has been a heavy over-cutting of the forests in an attempt to compensate for the lack of normal imports, and to supply the extraordinary demands of the war program.

3. The elimination of the normal importation of coal from England and Germany has had the most serious effect on the cutting of immature and young forests for fuel wood and charcoal.

4. The destruction of 1,000,000 acres of forests of all kinds along the front. This was done both by destructive shell fire as well as by cutting by the warring armies for lumber, timber, fuel wood, camouflage work, etc.

There are no figures available showing the annual production of lumber and forest products during the past three years, but it is estimated that the normal annual cut for fuel wood and charcoal amounting to about 9,500,000 cubic meters has been increased 100 per cent, and the cut of lumber and other forest products, aside from fuel wood, has increased from 175 to 200 per cent during the past three years. Italian War Department officials estimated that over 20,000,000 barbed-wire entanglement stakes were required for their army of 5,000,000 men in the year 1917 and probably 25,000,000 to 30,000,000 for 1918. It is generally estimated that little lumber production of any consequence will be possible in Italy for the next ten to fifteen years or more. Before the disaster of Caporetto in October, 1917, the Italian line was longer than the entire western front across France and Belgium. This line was largely in the Julian and Carnic

Alps, which were formerly well forested in places. Altogether 4,800 square miles of Italian territory have been over-run and devastated to a greater or less extent. This compares favorably with the 6,000 square miles devastated in Northern France. Consequently Italy has a great reconstruction problem to face.

The National Parks and "summer resort forests," on which all cuttings had been previously prohibited by law, as at Vallombrosa, Camaldoli, Mandrioli, etc., have been largely sacrificed for the war program. The normal annual cuttings at Vallombrosa to maintain the forest in the best condition was 6,000 cubic meters, whereas in 1917-1918 over 54,000 cubic meters were cut; consequently the future cut has been discounted for a period of nine years. The love of the Italian people of the forests was strikingly shown when the government, in the spring of 1918, announced its intention of cutting the well-known forests of La Verna, in the Apennine Mountains of Tuscany. These forests had been made famous and even sacred in the eyes of the Italians as the retreat of St. Francis of Assisi, and so violent became the wave of resentment against the destruction of that beautiful old silver fir forest that the officials of the War Ministry decided not to cut it.

The personnel of the Italian Forest Service has lost heavily in the war. All able-bodied men up to 45 years of age were in the combatant forces. Forest cuttings were handled entirely by expert lumbermen under the leadership of a prominent Milan lumberman who had managed extensive operations in other countries as well as in Italy. The cuttings, however, were supervised by local forest inspectors. Men unfit for service at the front were assigned for duty with the men making cuttings, all of whom were militarized. The method customarily followed consisted of clear-cutting the areas, followed immediately by planting, either in the fall or spring, with silver fir (*Abies pectinata*). Austrian prisoners were in many cases used in the work of both nursery maintenance and in the actual work of reforestation.

Soon after Italy entered the war, in May, 1915, the timber most accessible to the front was cut, and as this became exhausted the timber in Piedmont, Lombardy, the provinces next to Venetia, where the actual fighting took place. Gradually, however, the entire peninsula was scoured to supply the needed requirements. At first only the better silver fir and spruce were taken, then the pine and white oak, then the poplar and ash, and finally every species of almost any kind was taken, including beech, eucalyptus, alder, maple, birch, beech, acacia, and various other hardwoods. Even many olive trees and

cork oaks were cut until finally a decree was issued prohibiting the cutting of these trees.

In many cases motor trucks were employed to transport timber, formerly so inaccessibly located that it could not be cut and delivered to market at a price to compete with the imported stock prior to the war. This held true of several forests in Calabria and Tuscany, where lumber was transported as far as 26 miles by trucks. And this was resorted to in spite of gasoline shortage, for no private motor cars or trucks were permitted to operate in Italy during the years 1917 and 1918, not even physicians being permitted their usual cars. Switzerland increased her exports to Italy on the proffer of war prices, and the amount of lumber sent to Italy increased from 14,696 tons in 1913 to over 75,000 tons in 1915. Italy, moreover, has sent lumber to Macedonia for the Balkan front, and to Palestine and Egypt for the English armies, and even as far as Mesopotamia during the war. This seems a paradoxical situation, and yet Italy was the nearest and most available supply of timber for those treeless countries. The only lumber brought to Italy during the war was used exclusively for war purposes, and consisted largely of aeroplane stock. So acute was the demand for this material that the local silver fir, poplar, and pine were used for the inside frames, and even local beech, ash, and walnut were used for propellers. The wing beams were made of Douglas fir and western spruce from this country.

Although Italy had a difficult problem to face before the war, her forest problem of the immediate future is much more pressing and difficult. The only apparent solution of the situation presented by the destruction on the high mountain forests seems to be immediate reforestation. The cuttings on the State forests during the war have already been renewed by almost immediate reforestation.

Italy must import a much larger amount of forest products in the future, and this is going to be exceedingly expensive, saddled as she is with her great war debts. One of the first problems which Italy has to face and which must be solved is her forest problem. Essentially a mountainous country, Italian foresters estimate that at least 32 per cent of the area of the country should be under forest growth. With the readjustment necessary to the conclusion of peace, the protection of her water-power properties, the reforestation of her bare and denuded mountains, and the management of her forests to supply a large share of her wood requirements in the future have become national problems of much great moment and meaning.

A FORMULA METHOD FOR ESTIMATING TIMBER

By E. I. Terry

I. A FORMULA FOR WESTERN PINE

Form factors have been but very little used in American mensuration, because they are not directly applicable for determining the contents of trees in board measure. About three years ago, while estimating western yellow pine in Colorado, it occurred to the writer that a rule-of-thumb formula might be worked out by using the merchantable form factor and the ratio between the actual average cubic and board-foot contents of the trees of each diameter class. It is well understood that there is no one converting factor by which the cubic contents of trees of all sizes can be reduced to board-foot contents with any degree of accuracy. But for a given species in a given region, where growing conditions are nearly uniform, it seems to be a reasonable assumption that the ratio between the cubic and board-foot contents (considering only the merchantable stem) of the trees of each diameter class will be practically constant. By merchantable form factor, as used in this article,. I mean the relation between the volume of the merchantable stem of a tree and a cylinder having the same diameter as the d. b. h. and the same height as the merchantable length of the tree.

Another assumption which I have made is that only one form factor need be used for each diameter, regardless of height. In order to determine whether this assumption be justifiable, I worked out for each fifth inch diameter class the form factors for five-foot lengths, the results of which appear in Table 1. The values are somewhat irregular, but certainly no progressive change is evident from shorter to longer lengths for any diameter class.

But a formula, to be of practical use not only to foresters, but to cruisers and woodsmen generally, must be simple in form and based upon units of measurement which are both familiar and easily determined. Obviously, the dimensions best meeting those conditions are the breast-height diameter in inches and the merchantable height of the tree in feet. The latter is usually calculated in logs or half-log lengths, ten-foot sections, etc., any of which can readily be reduced to linear feet. Nor must a formula, if it is to be of general use, contain a large number of variable factors which must be memorized or carried in a

TABLE 1.—*Merchantable Form Factors Arranged According to Diameter and 5-foot Lengths*

D. b. h. (inches).	Merchantable length in feet.											
	40	45	50	55	60	65	70	75	80	85	90	95
15..........	4 63	6 60	2 69	4 58	1 50	4 57	1 49	1 59	..	..	..	..
20..........	1 56	3 56	9 53	16 52	5 49	13 51	8 51	6 54	2 51	..	1 56	..
25..........	..	..	2 56	2 55	5 48	11 50	4 51	12 48	9 51	6 51	7 49	2 53
30..........	..	..	..	..	..	..	3 47	5 47	6 49	5 46	5 43	2 47
35..........	..	..	..	..	..	6 51	..	3 53	5 42	..	3 50	..

The small figure in the squares denotes the number of trees of the respective diameter and length upon which the form factor was computed.

table and the correct one applied to a tree or group of trees falling within certain size limits. If very accurate results are sought, a table should be used in the first place.

It was with the above-mentioned requirements in mind that I tried to evolve an empirical formula which would be sufficiently accurate to be of use in many cases of estimating. Part of the tree measurements upon which it is based were made by myself and students in the Manitou Forest—adjoining the Pike National Forest—and part by Forest Service officers on the Montezuma Forest for volume-table purposes, the data being lent to me by the district forester. The trees may be considered representative of the mature western yellow pine in the Central Rockies. The make-up of the formula and the principle upon which it is based are expressed by the following equation, which is nothing more than the formula itself before reduction to its simplest form:

$$Bf = \frac{\frac{\pi}{4} D^2}{144} \times L \times F \times R$$

Bf = volume in board feet.
D = breast-height diameter in inches.
L = merchantable length in feet.
F = the merchantable form factor.
R = ratio of board feet to cubic feet.

The expression must be divided by 144, because D is expressed in inches and L in feet. It will be seen at once that all the terms except

R when multiplied together give the cubic volume of the merchantable stem of a tree of a given diameter, and if the volume be multiplied by the number expressing the ratio of board to cubic feet for trees of that diameter, the contents in board feet will be obtained. This equation may be reduced to the form

$$Bf = \frac{D^2 \times L}{n}$$

and

$$n = \frac{144}{.785 \times F \times R}$$

But it is evident that n, although correct for any diameter for which it may be determined, will not be the same for any other diameter, unless F and R remain constant for all diameters—which they do not—or unless the *products* of F and R for every diameter are approximately equal. It is here that an inspection of Table 2, and especially of columns F, R, and P ($P = F \times R$), is interesting as showing the relation between the form factors and the board foot-cubic foot ratios with change of diameter. As the diameter increases, the numerical value of the form factor decreases (though not very regularly), while the ratio increases, with the result that the range of values for P varies so slightly throughout the range of diameters for Rocky Mountain yellow pine (12 to 36 inches) that the average value for all diameters (3.213) may be used for each diameter class without involving an excessive error, and one which is compensating when applied to a fairly large number of trees. The greatest variation above the mean (that for the 34-inch class) is 12 per cent, and the greatest below the mean (for the 25-inch class) is 10 per cent, while for most diameter classes the difference is much less. Substituting, therefore, the average value of P for $F \times R$ in the formula for n, we have for any diameter

$$n = \frac{144}{.785 \times 3.213} = 57.1$$

or, approximately, 60, which is close enough to use in the formula. The resultant formula, therefore, for Rocky Mountain yellow pine is:

$$Bf = \frac{D^2 \times L}{60}$$

In the Pikes Peak region, where practically all the merchantable yellow pine (exclusive of tie-timber) ranges between 16 and 30 inches d. b. h., I have used this formula with satisfactory results. The volumes obtained by it show an average variation of about 10 per cent from those

given in the western yellow pine volume table for the San Juan and Montezuma Forests, compiled by Hoffman. They vary by about 12 per cent for the extreme lowest diameters and by 15 to 20 per cent for the extreme highest. For diameters below 24 inches, the formula gives values averaging higher than those given by the table, and above 24 inches values averaging lower. It will give results within 6 per cent of the table for nearly all diameters and log lengths if the following denominators be used:

70 for trees from 12 to 19 inches d. b. h., inclusive.
60 for trees from 20 to 29 inches d. b. h., inclusive.
55 for trees from 30 to 35 inches d. b. h., inclusive.
50 for all trees above 35 inches.

The San Juan-Montezuma table gives volumes for trees up to 43 inches.

In estimating small to medium-sized timber, such as the yellow pine of the Central Rockies, it is considerably more accurate to use a shorter unit of length than even the half-log (8-foot sections). I have found that estimating to the nearest "quarter-log" and also to the nearest 5 feet of merchantable length to give very accurate results. With such a formula as the one here given, the volume for any merchantable length may be computed. Heights can be obtained quickly and with sufficient accuracy by using a home-made hypsometer, constructed on the principle of the one on the Biltmore stick or on that of the Christen Height Measure.

The basic formula

$$Bf = \frac{.785 \times D^2 \times L \times F \times R}{144}$$

can, of course, be used for other species than yellow pine, but the appropriate data must be collected and worked up for each species, as in making volume tables. In all probability the value (or values) of n will differ for different species. Data have been collected for the other important timber trees of the Central Rocky Mountain region—the lodgepole pine, Engelmann spruce, and Douglas fir—but have not yet been worked up. It may be found that this formula will not give sufficiently accurate results for very large timber, such as that of the Pacific Northwest; or it may do so if several values be used for n, each applied to a certain diameter group.

II. THE CONSTRUCTION OF VOLUME TABLES BASED ON THE FORMULA

After deriving the formula it was perceived that a volume table, based on the d. b. h. and any chosen unit of merchantable length, could

be constructed from the data as arranged in Table 2, which should give much more accurate results than the formula, and perhaps more accurate than volume tables made up in the ordinary manner. The usual method in constructing tables based on diameters and log lengths is to plot on one sheet a set of curves—each curve for a given length of tree. When a table is constructed, even for half-log lengths (to say nothing of shorter length units), the curves as plotted are generally very irregular, crossing and recrossing one another in a tangled network. Of course, they can be straightened out by the process of "evening" and "harmonizing," but after that has been done the most competent and conscientious compiler may seriously question whether he has not "evened out" a large percentage of their accuracy. By the following method that disadvantage is overcome, for only one curve need be drawn in constructing the entire table.

From the basic formula (see page 416) the following equation may be deduced:

$$b = \frac{.785 \times D^2 \times F \times R}{144} = \frac{.785 \times D^2 \times P}{144}$$

b being a factor which, when multiplied by the merchantable length, will give the board-foot contents of the tree, as expressed by the equation

$$Bf = b \times L$$

The value of b must be determined for *each* diameter class, and these values can then be plotted and evened with a curve.

Values for b may also be derived from the formula

$$Bf = \frac{D^2 \times L}{n}$$

by dividing the square of each diameter by n. But a table of values thus derived will exhibit the same defect as the formula, namely, that with increasing size of the tree the true variation in contents from diameter class to diameter class is not determined. Figure 1 shows the curve (solid line) for the values of b; also, for comparison, the curve (broken line) which is obtained by plotting the points for each diameter as derived from the equation $b^1 = D^2/57$. The exact value of n (disregarding the fraction) has been used in this case instead of the round number 60. The curve thus derived is, of course, a perfectly even curve, giving values partly higher and partly lower than the curve

produced by the more exact method. The values for *b*, as read from the curve, are given in the column headed *b* in Table 2.

TABLE 2

1 D. b. h.	2 No. of trees.	3 Total length.	4 Total scale.	5 Total volume.	6 F.	7 R.	8 P.	9 *b*.
12	30	1,037	2,830	586	.72	4.8	3.456	2.6
13	34	1,322	3,760	804	.66	4.7	3.102	3.0
14	58	2,414	8,660	1,781	.69	4.9	3.381	3.5
15	56	2,558	10,430	2,077	.66	5.0	3.300	4.0
16	56	2,480	11,370	2,278	.62	5.0	3.100	4.5
17	39	1,920	9,890	1,898	.63	5.2	3.276	5.0
18	39	2,160	11,960	2,256	.59	5.3	3.127	5.5
19	30	1,694	10,290	1,886	.57	5.5	3.135	6.0
20	29	1,708	11,415	2,083	.56	5.5	3.080	6.6
21	30	1,774	12,550	2,227	.52	5.6	2.912	7.2
22	30	1,863	14,470	2,542	.52	5.7	2.964	8.0
23	30	1,920	16,330	2,839	.51	5.8	2.958	8.7
24	30	2,011	18,485	3,152	.50	5.9	2.950	9.6
25	30	2,078	20,160	3,373	.48	6.0	2.880	10.5
26	30	2,077	25,710	4,111	.54	6.2	3.348	11.5
27	30	2,127	28,040	4,465	.53	6.3	3.339	12.6
28	30	2,078	30,330	4,722	.53	6.4	3.392	13.8
29	29	2,128	31,895	5,034	.52	6.3	3.276	15.1
30	30	2,194	35,200	5,398	.50	6.5	3.250	16.4
31	30	2,288	39,085	5,957	.50	6.6	3.300	17.8
32	30	2,171	41,035	6,165	.51	6.7	3.417	19.1
33	30	2,177	44,940	6,643	.51	6.8	3.468	20.4
34	17	1,241	28,490	4,181	.53	6.8	3.604	21.4
35	20	1,448	31,520	4,757	.49	6.6	3.234	22.2
36	18	1,448	32,035	4,717	.46	6.8	3.128	22.7
Average value for column P							3.213	

The number of trees of each diameter class, upon which the computations are based, is given in the second column; the total merchantable length of the trees in feet, in the third column; the total scale by the Scribner Decimal C rule in the fourth column; and the total volume computed to the nearest whole cubic foot in the fifth column. Column F gives the merchantable form factor for each diameter, which is obtained by dividing the total volume by the volume of a cylinder having the same diameter (column 1) and the same total length (column 3). Column R shows the ratio of board feet to cubic feet for each diameter class, obtained by dividing the total scale (column 4) by the total volume (column 5). Column P gives for each diameter the product of F and R, and column *b* gives the *board-foot form factor,* as read from the curve (see Figure 1) and explained in the text. In all computations the decimal 0.785 was used as one-fourth of π.

Having obtained the values for *b*, volume tables based on d. b. h. and merchantable length (log-lengths, etc.) can be readily constructed by using the equation $Bf = b \times L$. For the most precise estimating possible, a table of merchantable lengths in two-foot classes could be made. The values obtained may be rounded to the nearest five or ten board feet.

III. THE BOARD-FOOT FORM FACTOR

But it will be observed that, no matter what unit of length be used in estimating, the tally sheets may be worked up without using any volume table. All that is necessary is to compute the total length of the trees tallied in each diameter class and multiply that sum by the corresponding value of b, which will give the total volume in board feet for the trees of that diameter. Column b in Table 2, therefore, is in itself a table of what may be called board-foot form factors.

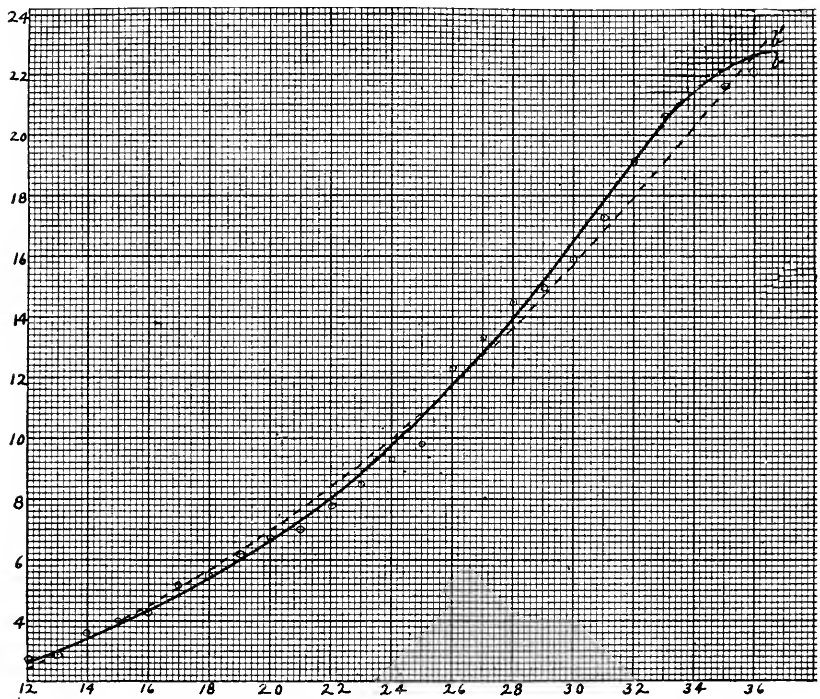

FIG. 1

In collecting the data it is unnecessary to measure the height of stump or the top of the tree beyond the upper cut (or the point that is taken as the upper limit of the merchantable bole if that should not coincide with the upper cut). The only measurements necessary to take on each tree are the length of each log to the nearest whole foot and the diameter inside bark of the stump and top end of each log, rounded to the nearest whole inch, as is the practice in scaling. Greater refinement is wholly unnecessary for any volume-table work. It is necessary to

obtain the stump diameter in order to cube the butt log. The measurement may, of course, be taken either on the stump or the log itself, but in the field-notes it is convenient to record it as the diameter of the stump.

TABLE 3.—*Twenty-inch Trees*

Tree No.	Stp.	1	2	3	4	5	6	Length.	Scale.	Volume.
1.....	21	16–17	16–16	16–12	8–8	...	..	56	430	77
2.....	20	12–19	16–16	16–13	14–8	...	..	58	460	80
3.....	21	16–18	16–16	10–14	10–8	...	..	52	460	77
4.....	22	16–19	16–16	16–13	12–9	8–8	..	68	510	94
5.....	21	16–17	16–15	16–11	12–8	...	..	60	420	75
6.....	20	16–15	16–13	16–10	12–8	...	..	60	320	60
7.....	21	16–18	16–16	16–12	20–8	...	..	68	480	86
8.....	21	16–17	16–15	16–12	18–8	...	..	66	430	80
9.....	20	16–19	16–15	14–12	18–10	8–8	..	72	520	88
10....	20	16–18	12–17	18–14	14–10	...	..	60	520	82

For recording the field data, I have found a book with a large page, such as the ordinary "day book," bound in stiff boards, to be the most convenient. One page is allotted to each diameter class, and one line is usually enough for recording the data on one tree, so that thirty or more trees can be recorded on one page. The form of notes which I have found very satisfactory is illustrated in Table 3, in which is recorded the data on ten trees of the 20-inch class. In the first column is the number of the tree measured, in the second (Stp.) the d. i. b. of the stump. The columns headed by numerals are for the log measurements, column 1 containing those for the butt log. For each tree the first number in each column is the length of the log in feet and the second is the top diameter in inches. The columns for length, scale, and volume need not be filled out in the field, but it is convenient to have such columns in the field book if there is room for them. The sum of each of these columns will be, respectively, the total length, total scale, and total volume for the trees of that diameter class, which totals may then be transferred to their respective columns in a table similar to Table 2.

Using the same data (given in Table 2), I have drawn curves based upon only a few diameter classes or diameter groups—as, for example, fourth or fifth diameter class—and find that the resultant curves are almost identical with the one based upon all diameters. It therefore seems reasonable to assume that accurate results may be obtained from the data of a comparatively small number of trees, provided a number

of trees each of a few diameter classes be selected, the classes representing, respectively, the smallest, medium, and largest sized trees of the timber in question. The curve for b could then be plotted upon these points and the intermediate values obtained from it. The method would involve a minimum of both field-work and computation.

Whether this method will give accurate results when applied to the large timber of the Pacific coast may depend chiefly on whether one merchantable form factor will serve for each diameter class, irrespective of length. If the form factor varies considerably with length, then several values of b for each diameter class would have to be computed.

But very little opportunity has as yet been afforded for testing the accuracy of this method, but it is presented as possibly possessing some merit and perhaps susceptible of improvement. I would consider it a favor to receive suggestions, and would be very glad, if any foresters in other regions care to try it, to be informed of the results obtained.

Comment on Professor Terry's Article

By W. N. Sparhawk

The purpose of the board-foot form factor proposed by Professor Terry appears to be to simplify the work of computation in working up timber estimates by doing away with the use of volume tables. It is evident that the use of b for all trees of a given diameter, regardless of their heights, by making separate consideration of the different height classes unnecessary, will considerably shorten this work.

I believe, however, that the method of computing b can be very much simplified without any sacrifice in accuracy. Dividing the values in column 4 (Table 2) by corresponding values in column 3, we get the following values for b:

D. b. h. (inches)	b	D. b. h. (inches)	b
12	2.7	24	9.2
13	2.8	25	9.7
14	3.6	26	12.4
15	4.1	27	13.2
16	4.6	28	14.6
17	5.2	29	15.0
18	5.5	30	16.0
19	6.1	31	17.1
20	6.7	32	18.9
21	7.1	33	20.6
22	7.8	34	23.0
23	8.5	35	21.8
		36	22.1

These values, which are substantially the same as those obtained by Professor Terry's method (maximum difference is 7 per cent), can, of course, be smoothed out by means of a curve, when they will be almost identical with his.

The only field measurements needed for preparation of a table of board-foot form factors would be (*a*) d. b. h. outside bark; (*b*) length of each section and diameter inside bark at top of each. The only office computation required would be: (*a*) grouping by d. b. h. classes; (*b*) computing board-foot scale for each tree from the top diameters and lengths of the separate sections; (*c*) division of total scale for trees in each diameter class by the sum of the lengths of trees in the respective classes; (*d*) evening off the resulting quotients, "b," by a curve.

This does away with computation of cubic foot volume, of F, of R, and of P in Terry's method.

THE CONTROL OF FLOOD WATER IN SOUTHERN CALIFORNIA.

EDW. N. MUNNS

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The control of floods has received more definite consideration in southern California than perhaps any other portion of the country, and control work used abroad, tackling the trouble at its source, has been applied here on a scale sufficiently large to show its worth. This thorough consideration of the water problem is due to the floods and the large quantities of silt and debris brought from the mountains by the storm waters during the rainy season, causing much loss to the fertile valley fields. Much of this material comes from the small tributary canyons at the headwaters of the streams, where grades are steep and the precipitation heavy. This detritus is deposited in the stream bed with the decrease in the velocity of the water, the coarser, heavier parts dropping near the mouth of the canyon, building up a debris cone, while the finer parts travel with the stream even to the point where the waters are finally discharged into the ocean. As a result, during very heavy storms the harbors are badly silted, and even during normal years considerable debris is deposited in the channels between the canyon mouths and the sea. This filling gradually increases the height of the stream bed and causes frequent shiftings in its location, the new channels often being through fertile, valuable lands, while the transportation systems, highways, and municipalities are badly damaged.

A large proportion of the erosion damage is caused by the silting of these lower channels, resulting in a decrease in their carrying capacity. As much of this debris is brought from the mountains, anything which would keep this soil in place aids greatly in the solution of the flood problem, for by restraining the water in its upper reaches the velocity is held below the point of excessive erosion. To this end check dams are used.

Check dams are small obstructions usually built of stone so placed across the channel that the water, though able to percolate through them to some extent, collects in a basin behind the dam and then falls vertically, or nearly so, over its front face. If the height of this

front face be made approximately three times the depth of the unobstructed stream it will cause the direction of the stream to be changed when it drops over the dam to a new one nearly at right angles to the one held originally. Thus at the face of the dam all motion in a *forward* direction is checked, and then this water is let *vertically* downward, so that by this process the elevation is overcome. The water during these drops attains a high velocity, but, as it is at no place in contact with the stream bed during its plunge, no erosion can take place and the energy of the fall can be dissipated upon an apron or water cushion at the foot of the dam. Thus water may be stepped down, so to speak, from one level to another, and if so built that the top of one dam is at the same level as the base of the next higher one there can be but little erosion.

In the settling basins behind the dams debris, rock, and sand are deposited, and as time passes and repeated high waters bring the soil down from the canyon slopes, these settling basins receive and hold more and more debris and become storage reservoirs in addition to checking the velocity of the stream, holding back the water and permitting its escape gradually after the storms are over. This effect may quite possibly extend well into the summer months, or, as in those cases where there is an underground artesian basin, may permit this water to escape from the canyon bed directly into the artesian basin, where it manifests itself in the rise of the water in walls tapping the basin.

HAINES CANYON AND THE SUNLAND DRAINAGE BASIN.

The Sunland drainage basin, in which this work has been done, is an area of 6½ square miles, 1½ square miles of which lies in the Angeles National Forest. This portion is in the Haines Canyon watershed, while the remainder includes, in general, open cultivated valley lands.

From the standpoint of flood waters, Haines Canyon is the most important part of this drainage basin. It is a steep, narrow watershed running up from the valley floor, at 2,000 feet elevation, to the summit of Sister Elsie Peak, which has an elevation of over 5,000 feet, and was burned over by an intense fire in September, 1913, the chaparral cover being completely destroyed. The soil is relatively deep, and is composed of a gravelly loam carrying considerable rock, varying in size from pebbles up to large angular fragments. The underlying rock, granite, is badly decomposed and much of the soil is derived from

it, though there are occasional areas with a gravelly loam. In the canyon bottom the wash shows much evidence of high-water action in the past, and boulders, gravel beds, and piles of debris indicate the high-water points of many floods. At the mouth of Haines Canyon is a large debris cone which has been built up by the erosion from this area, and on which a colony has been established.

Storms and Flood of 1914.

Since the area was burned over, in 1913, there have been two very heavy storms, the heaviest known since the region has become so heavily populated, and hence the most destructive in their effects. The first of these was from February 17 to 21, 1914. Most of the storm, which amounted to 7.04 inches, came in ten hours, one hour having 1.49 inches or 21 per cent of the total storm.[1] The damage occasioned was much greater than a storm of this character would have been because of the saturated condition of the ground and the high-water stage existing in the streams from previous rains. No precipitation stations were located in the mountains at this time, but it is certain that the fall was much greater than at Los Angeles, where the records here used were taken. An isohyetal map[2] prepared by the Weather Bureau for this storm gave the precipitation on this area of over 13 inches.

After the storms the height of the flood waters of various streams was measured and the maximum discharge per unit area computed from the water-marks by engineers. Of all the streams so measured Haines Canyon had the highest intensity, the maximum discharge being calculated as 712 cubic feet per second per square mile[3] and was the only one in which cover conditions had been reduced to a minimum.

This flood from Haines Canyon caused a tremendous amount of damage. Breaking loose from the old channel, the stream threaded its way through the suburban site, destroying a number of lots, swept across orchards and meandered through vineyards and grain fields, eroding and depositing according to the velocity, and causing damage running well into the thousands of dollars. The roads were washed out, school dismissed until the stream had subsided so that it was safe for children to cross, and business was at a standstill.

[1] Data from U. S. Weather Bureau Station at Los Angeles.

[2] Ford, A. Carpenter: "Flood Studies at Los Angeles." Mo. Wea. Rev., 42 (1914), pp. 385-391.

[3] F. H. Olmsted in Report of Board of Engineers Flood Control of Los Angeles County, August, 1915.

Storms and Flood of 1915.

In 1915 there were no storms which caused much damage, though there was one storm greater in intensity than that of 1914. This storm produced 9.85 inches of rain at Sunland, one inch of rain falling in an hour and fifteen minutes during the noon hour. Much water and considerable silt, rocks, eroded soil, and debris were brought down the stream and deposited in the wash of the stream, but the water failed to reach a volume which would cause damage to lands outside the canyon.

During the year the check dams in the canyon were constructed, some of them being in time to catch this storm. The result and effect of these dams, installed in Empire Canyon, will be discussed later.

Storm and Flood of 1916.

The storms of January, 1916, were much heavier than those of 1914 and the heaviest for which there is any record in this locality. The month began with a storm and the Los Angeles record for the first ten days was 2.91 inches. On the fourteenth the big storm began which lasted six days and produced a precipitation of 6.90 inches, followed by another storm four days later which gave a precipitation of 3.49 inches in five days. The first of these brought almost as much water as did the one of February two years previous, and did as much, if not more, damage, but the second storm caused by far the greater losses, as the ground was completely saturated and the streams were still at flood.

The Effect of the Check Dams.

In all, over five hundred dams have been constructed in this drainage basin, the greater portion being built of rock, though where the bed of the stream was not stable brush fagots were used to prevent the movement of the soil and to check the velocity of the water. More of these dams were built in the upper reaches of the canyon than lower down in order to keep the soil movement as high up in the area as possible. The movement of small bodies of water down one of these small side canyons was studied,[4] and it was found that with six dams installed on a 23 per cent grade the velocity was changed to that of a slope of 5.2 per cent.

[4] Report of F. H. Olmsted in Board of Engineers Flood Control to Board of Supervisors of Los Angeles County, 1915.

The big storms of January, 1916, gave these dams a most severe test and the results show clearly the value of such work. Thus in 1914 this Sunland drainage basin had a maximum discharge of over 700 second-feet per square mile, while in 1915, during the peak of the storm, the water failed to reach the Tejunga wash, into which it empties. At the mouth of the canyon there was a discharge which amounted to but eight second-feet and this water was clear and free from debris, while during the flood of 1914 the stream was exceedingly muddy, turbid, and was impassable.

During the 1914 flood period no school could be held at Littlelands, as the children were unable to get to the school-house on account of the high water. In 1916 children crossed the stream and assembled at the school-house during the storm, though, fearing a repetition of the flood of 1914, the trustees closed the school. At no time since the dams were installed has this stream been impassable, nor has there been any damage caused by the high water, a statement which cannot be made of any other drainage area in this region.

As mentioned before, but one small side canyon in the main drainage had the dams in place during the second 1915 storm. The first storm, which did not have near the intensity of the second, caused a large debris cone to be built up at the mouth of this canyon of twenty-two acres. After the dams had been built, during the second storm, no surface water reached the main stream, and where water was found in this canyon it was clear and free from debris which found lodgment in the basins behind the dams. All the other streams in this drainage were muddy and swollen and eroded their channels badly.

Adjoining Haines Canyon is another area heading up on the same peak with an area of but half that of Haines and with a fairly heavy stand of chaparral throughout. During the flood of 1916 this stream did considerable damage to its channel and to adjacent lands, while with a storm in October, 1916, amounting to 3.40 inches at Littlelands, it discharged enough water to carry gravel to the county highways half a mile distant from its mouth, while during this same storm, in the adjoining canyon, there was no appreciable rise in the stream nor was the water dirty or muddy.

In February, 1917, a recording stream gauge was installed in time to catch the discharge from the heaviest storm of the season. The daily discharge in second-feet per unit area from this canyon is shown on figure 1 (in dark) for the period from February to May, 1917, while there is also shown (in light) the discharge reduced to the same unit area on the same scale of the Little Santa Anita Canyon, which

has a very similar topography, altitudinal range, and characteristics, and geological formation. From the most casual comparison of the two areas the differences in the discharge is apparent. The hatched portion below the blocks indicates the amount of precipitation received, there being too little difference in the rainfall, either in intensity or in amount, to account for the great variation in the amount of water.

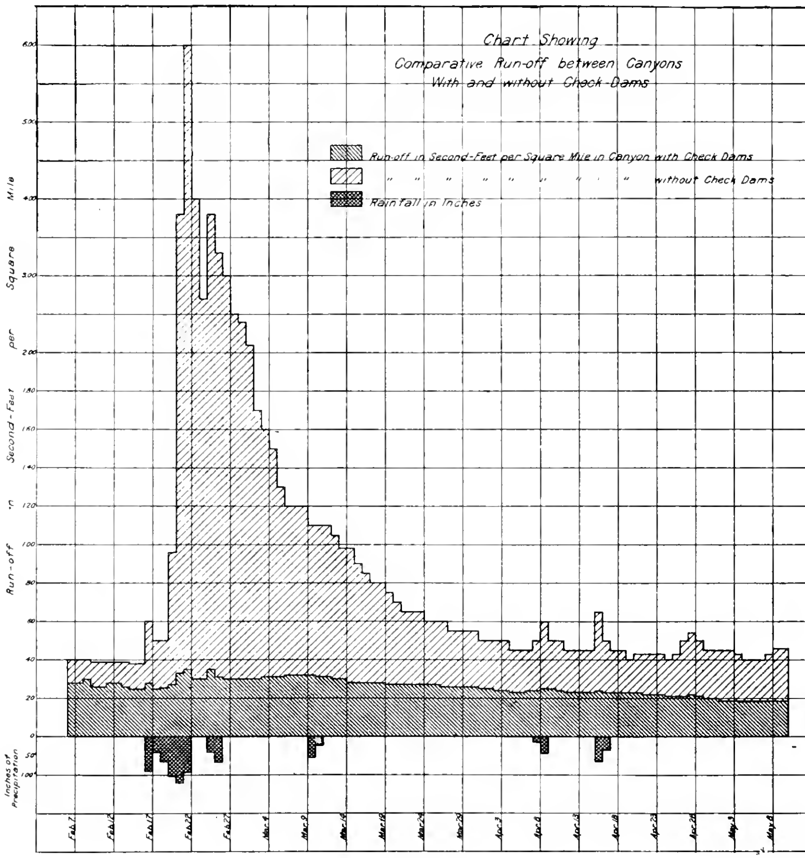

FIG. 1

While there is an increase in the flow from Haines Canyon with each heavy precipitation, this increase is exceedingly slight when compared to the very rapid run-off and high discharge for the other canyon during the same period. It is to be noted, in addition, the rapidity of the fall from the maximum which occurs in the stream without the dams and the sustained high flow of the canyon with the dams, which

up to the period of the chart is relatively constant. This flow likewise held up all during the past summer season, while the other stream dropped considerably when the hot weather commenced in earnest, though data is unavailable at this time.

There is one other point which deserves much consideration and which was not considered when the work was first begun. It has been mentioned that the settling basins held more or less of the transported soil, which acted as storage reservoirs. Much of this water that is so held back does not get into the stream again, but sinks into the gravels and supplies the underground water basin. How much this amounts to probably can never be determined, for practically all of the valley floor is underlaid by a big artesian belt. At the lower end of the debris cone on which Littlelands is built and which is the debris cone of Haines Canyon are a number of wells, and since these dams have been installed the water-level in these has raised around 50 feet, in spite of a deficiency in the precipitation and the increased amount of pumping due to the lessened flow from the various canyons nearby, and to an increase in the acreage of improved lands irrigated by water from the pumping plants.

From the work done it is easy to see the efficiency of these dams in reducing flood peaks, preventing soil transportation, and increasing the water supply. Such work is only the forerunner of much that is to be done and may be of as much value where rains are abundant, as in the Southwest, with its freakish and abnormal annual precipitations.

REVIEWS

The Available Resources of the German Forests. Les Resources Réalisables des Forêts Allomandes, G. Huffel, 15 pp.

Professor G. Huffel, of the Nancy Forest School, proposes a scheme in a special brochure for utilizing the mature and near-mature timber of the German forests to meet the reconstruction needs of France and her allies. He estimates that France will need 32,000,000,000 board feet[1] in the next five years to repair the damage of the war and that Great Britain must import during the same period 20 billion feet. Italy, Belgium and Serbia will need 10 billion more. So that the total requirements of the allies will amount to 62 billions. To this should be added the probable needs of Germany for the next five years. These are estimated at 64 billions, based on pre-war imports and home production.

To meet this requirement of 119 billion feet Germany alone has over 67 billion feet of mature timber in her State forests, while the communal and private forests have 62 billions more, or a total of 130 billion board feet. To this could be added the forest resources of Austria, 8,500,000 acres cutting 240 board feet per acre, and those of Hungary with its 2,500,000 acres of State forests alone.

M. Huffel's plan is to have the exploitation of this mature timber carried out by allied prisoners working under the direction of the commanders of the army of occupation, spreading the operation over five years. Germany would, of course, be charged a reasonable price for the lumber which she used. He is at considerable pains to explain that this appropriation of the German forest resources is fully justified under the circumstances and that unless some such scheme is carried out France will be greatly weakened. Her forest wealth is so depleted by the ravages of the Hun and the forced cutting to meet military demands that a century will be required to repair the damage. "Pour reconstituer une forêt il ne faut pas seulement un sacrifice d'argent, il faut du temps."

But the most interesting part of the brochure to the forester are the figures upon which is based the estimate of mature timber. There

[1] Figuring one cubic meter to make 200 feet board measure. This figure might be increased by 25 per cent.

is not space to give these in full, but two tables follow which summarize the most important data. The figures are based on official German statistics of 1900. Apparently it is assumed that these are conservative and that the growth will offset any overcutting or neglect that may have occurred during the stress of war.

The total forest area of the German Empire, excluding Alsace-Lorraine, is 33,500,000 acres divided as follows:

	Per cent
Crown forests	2
State forests	32
Communal forests	14
Corporation forests	3
Private forests	49
	100

8,800,000 acres are covered with mature timber which is divided into age classes, by species, as follows:

	Oak	Beech	Pine	Spruce	Fir	Total
Stands 61-80 yrs.	2%	10%	20%	9%	1%	42%
Stands 81-100 yrs.	1	9	13	6	1	30
Stands 101 yrs. and over	3	8	11	5	1	28
	6	27	44	20	3	100

The total stand of 130,000,000,000 board feet is distributed as follows among the upper age classes:

	Oak	Beech	Pine	Spruce and Fir	Total
Stands 61-80 yrs.	1%	5%	11%	9%	26%
Stands 81-100 yrs.	1	7	10	10	28
Stands 101 yrs. and over	4	14	15	13	46
	6	26	36	32	100

The total stand on the State forests, 67 billion board feet, has a stumpage value of approximately $20 per thousand.

K. W. W.

Meddelanden från Statens Skogsförsöksanstalt. Häfte 15, 1918. (Contribution from the Swedish State Forest Experiment Station, March 15, 1918.)

A publication of unusual interest is the annual report of the Swedish Forest Experiment Station for 1918, which has recently appeared in print. A large portion of it is taken up by administrative reports of the various divisions. These are as follows:

I. Forestry Division.
II. Research Division.
III. Entomological Laboratory.

IV. Division of Experimentation in Natural Reproduction in Norrland.

The activities of each division during the year 1917 and also for the triennial period 1915-1917 are outlined. The following articles are printed in full:

Edward Wibeck: Widens kulturplog.
Experiments with a plow designed for cultivation and seeding in the forest. Summary in German. Pp. 17-42.

Gösta Mellström: Skogsträdens frösättning ar 1917.
A survey of the seed crop of different species in Sweden, together with a discussion of climatic conditions affecting seed development. Such a report is prepared annually. Pp. 43-68. Summary in German.

Ivar Trägardh: Skoginsekternas skadegörelse under ar 1916.
A survey of insect damage during the year 1916, based mainly upon reports by field officers. The article also contains technical descriptions of the work of several of the important forest insects. Pp. 69-116.

Nils Sylven: 1917 ars knäckesjuka i norra Västergötland.
A pine disease which has done great damage to forest plantations in northern Vastergotland. Pp. 192-204. Summary in German.

L. Mattson: Stormhärjningen i norra Dalarna hösten 1917.
An account of damage by a tornado in northern Dalarna in the fall of 1917. Pp. 205-220. Summary in German.

Ivar Trägärdh: Tallbocken (Monochamus sutor L.).
A technical account of the activities of a pine borer which damages both living and dead trees. Pp. 221-232. Summary in German.

Sven Petrini: Formpunktsmetoden och dess anvädning för formklassbestämning och kubering.
A method of obtaining the form class and volume of single trees by the use of the form point, based upon spruce material. Pp. 233-274. Summary in English.

An outline of the program for the period 1918-1920, inclusive, which is summarized in English as well as German, is here reprinted.

I. THE PROBLEM OF FOREST REGENERATION

(*a*) *Seed Investigations.* Pine and spruce seed from different parts of Norrland shall be investigated yearly so far as the supply of cones will admit (F[1]). The investigation shall begin in a seed year suitable for the determination of the best time for gathering cones (S) and for the storage of forest seed (S and F). The biology of germination shall be studied in the case of the most important forest trees, with especial attention to the conditions of germination offered by the soil

[1] The letters in the text have the following meaning: S, indicates the Forest section; N, the Physical section; E, the Entomological section, and F, the section for regeneration experiments in Norrland.

(N). The existing sample plots shall be re-examined, and the results published (S). New sample plots shall be gradually laid out further south (S), with North Swedish pines and, in co-operation with other Scandinavian institutes of experimental forestry, concerning beech, oak, spruce, and alder (S). One or more series of experiments shall be instituted at different heights above sea-level with pine seed collected from different adjacent levels (F). The productivity of the seed trees shall be investigated with the object of determining the lowest age in different districts of the country at which such trees can suitably be left (S). The total quantity of cones from certain selected trees shall be collected annually, and the quantity and the quality of the seed obtained therefrom shall be investigated (F). Cones shall be collected from old pines and spruces in Norrland, and the quantity and the quality of the seed obtained therefrom shall be investigated (F).

(*b*) *Special measures for securing natural forest regeneration.* Existing experiments with different large clearings and gaps and thinnings shall be controlled and published (S). New experiments by means of thinning in accordance with Wagner's method, or by other methods of cutting shall be arranged when time permits; and in this connection attention shall be paid to the seed-producing capacity and success in regeneration attained by the margins of the stand at different points of the compass in the areas cleared (S). Areas intended to throw light upon the scattering of the seed, etc., on the tracts cleared in Norrland shall be laid out in four new series with a total area of about 16 hectares (F). Areas intended to compare the value of different treatments of the ground soil shall be laid out in Norrland in five new series with a total area of about 12 hectares (F); and in addition to this a few series of experiments in ground preparation shall be carried out in old spruce forests that have been thinned. Material shall be steadily collected regarding the effect of measures for reforestation on the humus covering of the ground (N).

(*c*) *Silvicultural measures.* The experiments instituted for determining the most suitable sowing time in Norrland shall be continued (F). Seven new series of plots, intended to compare different methods of sowing, shall be laid out in Norrland with a total area of about 2.3 hectares (F). Plots designed for investigating the most suitable age of the clearings for silviculture in Norrland, for which the laying out of two series has begun, shall be augmented by three new series (F). The course of growth in the roots of planted trees shall be investigated with a view to discovering the most suitable times of planting (N).

Plots designed to compare different methods of planting shall be laid out in eight new series with a total area of about 2.4 hectares (F). Older forest cultures carried out by notch planting shall be investigated, so far as opportunity offers (S and F). Existing forest cultures of pine and spruce, with various distances between the plants, shall be revised if need be (S), and new ones shall be laid out in the south and center of Sweden in the experimental parks contemplated (S). In Norrland five new series of such sample plots shall be laid out with a total area of about 6.6 hectares, both the older plots and these being supplemented with auxiliary planting (F). Plots intended for investigating the prospects of sowing and planting on different types of bog after draining shall be laid out in Norrland in twelve new series with a total area not exceeding 4.8 hectares (F). (See also 5*e* below.)

II. THE DEVELOPMENT OF FOREST STANDS

(*a*) *Productive yield of the forests and forest stands.* The investigations instituted in order to study the stem form of forest trees, especially pines, shall be continued (S). Material shall be collected and worked up for obtaining yield tables for pine and birch after a thorough low thinning (S). The oak shall be studied, especially on Visingsö, in order to make out a preliminary stand survey of its development (S). Studies shall be made on the length of the growing period in the most common forest trees (N).

(*b*) *Measures for the care of stands.* Existing sample plots shall be re-examined and thinned if necessary (S). New plots shall be instituted in different stands for studying the effect of thinning, especially of pine and birch in Norrland, but so far as time permits also in mixed coniferous forests and spruce stands (S); and in these attention should be paid to the possibility of setting apart for purposes of comparison untouched areas.

III. DISEASES AND INJURIES TO FOREST TREES

(*a*) *Injuries caused by adverse weather conditions* shall be studied when opportunity offers, especially on the sample plots (S).

(*b*) *Diseases and injuries caused by fungi.* Studies of rot fungi may also be eventually made (N).

(*c*) *Damages caused by insects* (E).

Investigations upon. Continued investigations shall be carried out, on the same methods as before upon the influence of the time of cut-

ting, the effect of the attacks on the crown on the growth and trunk formation, and the geographical distribution and rate of propagation of the two kinds of pine beetles in different parts of the country, and the best method of preparing trap trees.

Investigations into bark beetles. Continued studies of the distribution, biology, and importance of the different species in the various parts of the country. Studies of the development of the bark beetle in spruce and its connection with the climatic factors and the consequent importance of the time of cutting. The best method of preparing trap trees to be investigated.

Investigations into insects injurious to spruce and pine cones. These shall be continued according to the same plan as before, supplemented by investigations into the cone fauna during the summer. Experiments on the possibility, by investigating spruce cones in the summer, of predicting the quality of the cones, and experiments in killing the larvæ of the spruce-cone moth by hydrocyanic acid.

Investigations upon insects injurious to forest-tree plants in nurseries. Investigations into saw flies and other injurious insects that may possibly occur.

Other investigations. The investigations that have begun upon *Bupalus ptniarius* should be continued.

Studies in the importance of Pissodes and Magdalis, especially on the pine heaths of Norrland.

Studies in certain technical damage-doers, such as those done by the *Lamia sutor and Tetropium and in means of fighting them.*

Commencement of studies in the saw flies of pine and spruce trees.

See also under 5*e* and 6.

IV. RACES OF FOREST TREES AND THE USEFULNESS OF FOREIGN TREES IN SWEDEN

(*a*) *Studies in races of spruce and pine.* The cultures which have so far been or will be established of spruce seed collected for this purpose shall be followed and watched carefully (N), and, in addition to this, experiments should be instituted in fertilization with pure races (N).

(*b*) *German spruce seed.* Existing plantations, carried out by the forest authorities with plantings of spruce from different places in Central Europe, shall be sought out and registered (S).

(*c*) *Larch.* The permanent sample plots shall be re-examined when necessary, and thinned, with the object of obtaining yield tables

for the larch species in Sweden (S). Experimental cultures are to be carried out with different races of larch (S).

(*d*) *The silver fir.* Sample plots in existing stands of silver fir shall be laid out, to a limited extent, and thinning experiments shall be made with the object of investigating the growing capacity of those stands in comparison with that of the common spruce.

V. INVESTIGATIONS CONCERNING FOREST LAND

(*a*) *Types of soil.* A detailed study shall be undertaken into the forms of humus in coniferous forests (N), and the studies of the process of podsolization shall be worked up for publication (N). After this the mould soils of the forest shall be made the subject of investigation (N).

Ling-heaths. The mapping already accomplished shall be prepared for publication (S); likewise also the experiments or valuations in forest culture that have been made on ling-heaths with the object of showing examples of their productivity for purposes of practical forestry (S). Other studies of ling-heaths shall be continued (N).

(*c*) *The water-logging of the forests.* The work begun on this subject shall be prepared for publication (N).

(*d*) *The freezing of forest grounds.* The phenomena of freezing shall be studied, partly in combination with experiments in practical silviculture (N and F).

(*e*) *The conversion of moss lands into forest land.* Experiments in draining that have already been carried out shall be studied with reference to the conversion of nitrogen (N).

An examination of older ditching that has been effected in Norrland in connection with silvicultural experiments (F).

See also under I (*c*).

(*f*) *Investigations into the influence of the life of lower animals on the nature of the soil* shall be carried out, in addition to other ways, by the survey of clearings and of undisturbed stands (N and E).

VI. OTHER WORK

The preparation of reports by Royal Foresters on the setting of seed of forest trees shall be continued (S). Annual reports shall be issued of the injuries done by insects in the forest (E). Minor investigations which affect spheres of work in the different sections shall be carried out when opportunity offers (S, N, E, and F).

G. A. P.

Report of the Connecticut State Park Commission for the Two Fiscal Years Ended September 30, 1918. Hartford, 1919. 36 pp., 12 plates.

This report raises at once in the mind of the reader the question as to what constitutes the dividing line between a State Park and a State Forest. Since its creation in 1914 the Connecticut State Park Commission has acquired an area of 3,150 acres, scattered through some 18 towns and including mountain tops, woodlands, and river, lake, and seashore frontage. Of this area the State Forester estimates that approximately 3,000 acres are already forested or are suited for forest purposes. In other words, the forest land acquired for State Parks does not fall far short of the 3,702 acres now included in State Forests in Connecticut. Furthermore, nearly two-thirds of the State Park area is included in a single tract, most of which is covered with a stand of second-growth hardwoods.

Appropriations for the State Park Commission and for the Forestry Department have so far not differed widely. During the last two years, for example, the Park Commission has received an appropriation of $25,000, $20,000 of which has been for the acquisition of land, while the Forestry Department has received an appropriation of $31,000, $10,000 of which has been for the purchase and maintenance of State Forests. The Park Commission, however, has ambitious plans, the accomplishment of which would leave the State Forests far in the rear. Two years ago it stated its belief that in the next decade the State should spend four or five million dollars for park purposes, and asked for a specific appropriation of $150,000 for the acquisition of lands, suggesting at the same time the wisdom of issuing bonds to cover such an appropriation. This year it is asking for an appropriation of $200,000 for the purchase of land and of $170,000 for development work. The request is justified on the ground that an immediate demonstration is needed of what is meant by a State Park in its largest and fullest sense, since "a park is not a park until it is used and enjoyed by the people to whom it belongs."

On general principles it would seem to be better policy to devote the bulk of this money to the acquisition of State Forests. Areas now under consideration by the Park Commission could be secured and their recreational possibilities developed, while at the same time their forest resources could be improved and utilized under the direction of the Forestry Department. The Secretary of the Park Commission defines State Parks as being "for the use and enjoyment of the

people of Connecticut." So far as forest lands are concerned, these requirements can be met satisfactorily by publicly owned forests administered by trained foresters, as has been amply demonstrated in the case of the National Forests and State Forests elsewhere. In Minnesota, for example, the State Parks are under the supervision of the State Forester, and in general are handled in the same way as State Forests, while in New Hampshire even the Crawford Notch Reservation, which was acquired primarily for scenic purposes, comes under the jurisdiction of the State Forester.

The intimate relation that exists between State Parks and State Forests is evidently recognized by Connecticut through its action in making the State Forester an ex-officio member of the Commission, and in appointing another forester (H. H. Chapman) as a member of the Commission. It would seem preferable, however, to go much further than this and either to transfer the bulk of the work now being handled by the Park Commission to the Forestry Department, or at least for the Commission to turn over to the latter for administration such forested areas as it may acquire. With the possible exception of limited areas fronting on Long Island Sound, practically all of the tracts being acquired by the Park Commission could be used to excellent advantage for forest purposes. The majority of these tracts could undoubtedly be made a paying investment, both from a recreational and a purely business point of view, while mountain tops, to which the Park Commission appears to be very partial, could be used as fire lookout stations. Unless some such consolidation as that suggested can be made effective, there is almost sure to be more or less overlapping of the work of the State Park Commission and the Forestry Department and tying up of forest lands which could equally well be used for forest purposes without in any way interfering with their recreational value.

PERIODICAL LITERATURE

First of German Periodicals

The first magazine literature from Germany that has reached us since the beginning of the war is made up of two issues of v. Tubeuf's *Naturwissenchaftliche Zeitschrift für Forst und Landwirtschaft.* Their dates give us an inkling as to conditions under which they are published; the first being a double number for January-February, 1918, the second combining the months March to August under one cover (without explanation). War conditions are also reflected in a lengthy account of methods to gather beechnuts for their oil to eke out the scarcity of fats. It appears that 1916 was a beech mast, and, remarkable to tell, 1918 promised even a better mast, which usually occurs only in periods of 4 to 7 years. One hundred pages are devoted to the distribution in Switzerland of the mistletoe and to the insects feeding on it.

The most important contribution, and of interest to us, consists of a symposium on the production of rosin, needed in so many industries and not obtainable by importation.

It also covers around 100 pages in 12 articles by various authors, the outcome of studies, experiments, and practices under the direction of a war commission.

The Scotch pine and Norway spruce are the species concerned. Various methods of tapping the trees are described and their results compared. The "American" pot method and an improvement (?) by Splettstoesser called the "fishbone" method are found the most satisfactory, leaving the preference of these two undetermined. Briefs of the several articles will appear in the subsequent numbers of the Journal.

BOTANY AND ZOÖLOGY

Heredity of Spruce Sports

Fischer, of the Berne botanical garden, reports an interesting proof of the heredity of monstrosities or sportive forms. A specimen of Norway spruce—*Picea excelsa virgata Cranstonii* Carr.—which developed without branches—a serpentine spruce—bore fruit in 1905, no attempt having been made to control pollination. The many seedlings

arising from the sowing showed the greatest variety of forms from normal to those showing from the start the serpentine type. The most striking, pictured, shows at the base a number of sparely twigged branches; from the year 1913 it has grown without any branches and for the five years following the annual shoots were 14, 16, 12, 14, 7 inches, the total height being 10 feet. Other measurements are recorded, making the average annual shoot of the branchless plant 10 inches. (Since no precautions were taken to prevent cross-fertilization the Mendelian law could not be tested.) A specimen of pronounced serpentine spruce type was transplanted in 1915, which changed its habit completely in that on main stem and branches densely bushy shoots developed; the original specimen transplanted, also in 1915, showed the same change, suggesting that the transplanting was the cause of the change.

An account of branchless Abies is to be found in *Forestry Quarterly*, XIV, p. 323.

Schweizerische Zeitschrift für Forstwesen, January-February, 1919, p. 10.

Acer rubrum Varieties

Freda Detmers describes two new varieties of *Acer rubrum* L. One, which he calls var. ***viride,*** is so called from its most striking feature, its greenness. The leaves develop early, from one to two weeks before those of surrounding trees, and are green as soon as they unfold. Samaras are also always green. The other variety, *rubro carpum,* seemingly based upon one specimen distinguishes itself, and making it conspicuous, even among red maples, by the deep red of the buds, young twigs, flowers, mature fruit, and unfolding leaves.

Ohio Journal of Science, February, 1919, pp. 235-7.

SOIL, WATER, AND CLIMATE

Effect of Volcanic Eruption

R. F. Griggs gives an account of the effects on vegetation of the eruption of the crater of Katmai (situated in an uninhabited wilderness in Alaska near Kadiak) in July, 1912. Summarizing the result of the tremendous cataclysm, we learn that 7,300 square miles were covered with ash so deeply as to destroy the smaller plants; that rains bearing sulphuric acid in such concentration as to destroy gardens occurred as

much as 300 miles from the volcano; that death-dealing blasts from the volcano killed trees 25 miles away, destroying the forest over an area of more than 1,500 square miles; that ashfall, so heavy as to obliterate all herbaceous plants except on steep hillsides, etc., covered an area of about 970 square miles; that mud flows so hot as to reduce to charcoal all vegetation with which they came in contact were poured out over an area of about 53 square miles; that an area of about 39 square miles, in which there is no trace of former vegetation, was probably swept by fires of great intensity, making the total area in which all life was annihilated 140 square miles.

The investigation into the exact causes of the character of the destruction in the different zones of destruction remained rather inconclusive, whether in a given zone ashes or heat or acid, rain or hot blast or heated mud flow was to be held responsible could not with certainty be determined. The investigation reported was made three years after the eruption. The herbaceous vegetation was found to be partially restored on areas covered with ash to the depth of not more than one foot. Certain grasses and the scouring rush in great luxuriance have overrun large areas. A river in flood in 1915 washed away a mantle of ash from three to six feet deep and many plants which had lain dormant for three years resumed their vegetative activities. Explanations of the cause of this dormancy are again inconclusive. The trees suffered much more than the herbaceous vegetation, since they were not protected by the ash covering. In order of injury the author lists alder, birch, balsam, poplar, and willows. The latter have the advantage in putting forth adventitious roots in abundance in the new soil and go on with little apparent indication of disturbance. The alder was completely exterminated and the birch nearly so. Dormant buds protected by heavy bark from poisonous or scorching blasts have carried on the life of many poplar trees for three years, but it is apparent from the illustrations of the text that most of them will finally succumb.

The Ohio Journal of Science, January, 1919, pp. 173-209.

SILVICULTURE, PROTECTION, AND EXTENSION

Forestation in Central France

As a result of planting experiments instituted in November, 1909, with 1-year-old seedlings, L. Chancerel concludes that *Q. palustris*, *Q. rubra*, *Q. phellos*, *Betula nigra*, *Alnus cordifolia*, *Populus balsamifera*, and *P. nigra* (var. *angulata robusta* for single trees) in

the case of hardwoods; and *Pinus maritima* (var. *corte*) in mixture with *P. sylvestris, Pseudotsuga douglasii* (*P. taxifolia*, variety not mentioned), *Picea menziesii*, and *Cedrus deodara* (for single trees) in the case of conifers, are to be particularly recommended. These conclusions are based on the assumption that it is desired to obtain the maximum amount of woody material in the shortest time and to increase rapidly the value of the poor silicious soils in the region concerned. These soils, which are very dry in summer and wet in places in winter, present most unfavorable conditions for agriculture.

The English and pedunculate oaks were found to be unsuitable because of their very light foliage during the first years and their liability to injury from fungi. *Q. phellos* made the best growth of the oaks, reaching a diameter of 12 centimeters at one meter from the ground, a merchantable length of two meters, and a total height of five meters. On the basis of 5,000 plants per acre, it produced about 12 cubic meters per hectare in 10 years.

Betula alba, B. populifolia, and *B. papyracea* (*papyrifera*) all grew well, but were surpassed by *B. nigra*, which reached a diameter of 24 centimeters and showed a production of 50 cubic meters per hectare in 10 years. Approximately the same production was attained by *Alnus cordifolia*.

Of the poplars, *Populus nigra* (var. *angulata robusta*) did the best, while *P. balsamifera* was also considered worthy of note, producing a large dense crown and having the power of reproducing by layers. Elm, maple, basswood, ash, hornbeam, chestnut, hickory, and walnut all did poorly.

Among the conifers maritime pine is regarded as the most satisfactory species, several specimens obtaining a diameter of 24 centimeters, a height of 5 meters, and a production of 50 cubic meters per hectare in 10 years. The author believes that this species has suffered unjustly in popular esteem because of the severe frosts of the winter of 1879-80, which killed a number of stands of maritime pine in Central France. He points out that temperatures as low as those of that winter are very rare, and that maritime pine has proved able to resist a temperature of —16 degrees. If one does not care to plant it in pure stands, he recommends it heartily in mixture with other species, and points out that its growth during the first 10 years is extremely rapid. *P. sylvestris* (var. *riga* and var. *scotica*) has done well, but is much slower growing than the maritime pine. Curiously enough jack pine, while exhibiting about the same rate of growth as the Scotch pine, is

said to suffer from drought during the summer, as a result of which a number have died.

Abies concolor is the only one of the firs that has proved to be vigorous. *Cedrus deodara,* like the Atlas cedar and the cedar of Lebanon, is slow growing, but maintains its growth better than those species and is also ornamental. *Picea excelsa* has not done so well as *P. menziesii.*

Among the American conifers special mention is made of *Pseudotsuga douglasii* (*taxifolia*), which attains a diameter of 18 centimeters and a height of 4 meters. It is regarded by the author as a tree of the future which grows on the most unfavorable soils.

S. T. D.

Les Meilleures Essences de Boisement dans Région du Centre. L. Chancerel. Revue des Eaux et Forêts. February, 1919, Vol. 57, pp. 31-33.

Root Habits of Trees in Northern Canada

The preponderance of spruce in north-central Canada is usually ascribed to its greater tolerance of low temperatures than that of the predominating trees of the more temperate climates. It is frequently inferred that the *direct* effect of temperature upon physiological processes controls plant distribution in the far north. Howard E. Pulling shows how low temperatures may retard the growth or limit the size of certain arborescent species in an *indirect* way.

The root habits of *Picea mariana, Pinus banksiana, Larix laricina, Betula papyrifera, Populus balsamifera* and *Pinus strobus* were studied in the Province of Manitoba between latitude 55° N. and 56° N., and longitude 96° W. and 98° W. in a uniform clay soil and in a sandy soil near the south shore of Lake Superior in Douglas County, Wisconsin. The main characteristics of the root systems are exhibited in dimensioned figures. The soil was found to be generally shallow and frozen at depths ranging from 2 meters on the exposed south slopes to 3 cm. on flat benches with a northern exposure which acted as a mechanical barrier to root penetration.

These trees were found to differ not only in their root habits, as they do in their top habits, but also in the rigidity with which the habits are maintained under varying environmental conditions. This investigation is summarized as follows:

Root systems may be classified as deep when the habit is centered about a main deeply penetrating tap root and shallow when such a tap root is absent, and the roots remain near the surface of the soil.

Various degrees of transition may be recognized, but the important point is that some trees have a very rigid root habit, while with others it is more flexible. Deep-root systems of an inflexible nature cannot produce large trees in shallow soils, whether the shallowness is caused by rock or ice. Trees whose root systems are flexible and are not too deep-rooted in deep soils may endure shallow soils. The degree of flexibility of habit and the degree of penetration in deep soils may determine the northward distribution of many plants, regardless of relations between the plant and its environment that may exclude other species from those regions. Of the species studied, black spruce, tamarack, and birch are classed as having a rigid shallow-root habit; white spruce, a flexible shallow-root habit; balsam poplar, a deep, flexible-root habit; jack pine and white pine, a deep, rigid-root habit.

C. F. K.

Pulling, Howard E.: Root Habit and Plant Distribution in the Far North. The Plant World 21 : 223-233, September, 1918.

MENSURATION, FINANCE, AND MANAGEMENT

Forest Taxation in England

M. Arnould cites an article by the President of the Royal Scottish Arborcultural Society in the Society bulletin for July, 1918, as proof that the increasing burden of forest taxation is not peculiar to France, but exists also in England. In the article referred to, the Duke of Buccleuch gives figures for two tracts owned by him, on the first of which the annual tax amounts to 122 per cent of the annual revenue, and on the other to 132 per cent of the revenue. Without the supertax imposed as a result of the war the other taxes in the first case would have absorbed nearly 86 per cent of the revenue, and in the second case nearly 100 per cent. Particular attention is called to the fact that forest products are the only kind of property forced to pay both the so-called "death duty," amounting to 21 per cent of the value of the products sold, and the income and supertaxes amounting to 52½ per cent. Figures are quoted from the report of the Forestry Subcommittee of the Reconstruction Committee to prove the impracticability of reforestation under such taxes as these. In the case of a Sitka spruce plantation, for instance, the net loss under these taxes at the end of a 70-year rotation at five per cent interest would be 285 pounds 18 shillings per acre, and at 2½ per cent 29 pounds 7 shillings. M. Arnould concludes his paper with renewed emphasis on the injustice of present methods

of forest taxation in England and France, and the hope that forest owners in England will be able to secure a revision of the income tax as applied to forests on a fair and rational basis which can be adapted to French legislation. S. T. D.

Revue des Eaux et Forêts, January, 1919, Vol. 57, pp. 2-3.

UTILIZATION, MARKET, AND TECHNOLOGY

Swiss Notes

In a review of Swiss conditions during the war, Barbey refers to the large exportations of forest products for use of the American Army, which last spring brought the price of fir logs in the woods to 48 and 54 cents per cubic foot, which may be figured at $60 to $65 per thousand feet b. m. This astonishingly high price is exceeded for certain other species, *e. g.*, white pine (our *P. strobus*, which is a regular market article in Switzerland) for match manufacture, at 75 cents per cubic foot or over $90 per thousand feet. Railroad ties doubled in the last four years to about 50 cents a cubic foot or $2.50 per tie. Meanwhile, transport charges on railroads have increased 80 to 100 per cent.

The *Journal Forestier Suisse* also brings statistics on this subject. Standing timber of spruce and fir in another place was sold at from 20 to 38 cents ($25 to $36 per thousand feet board measure) with a cost of 3 to 4 cents for cutting and 8 to 14 cents for delivering at mill or railroad, so that the cost of logs may go up to $70 per thousand feet board measure.

Comparison with prices of 1917 shows increases of 30 to 40 per cent and more. The maximum prices fixed by the Department of the Interior for 1918-19 run from 40 cents to 58 cents per cubic foot, free on board or mill.

According to Barbey the problem of supplying the pulp and paper factories has become an important one. At one time these were on the point of closing because of the demand for firewood, and the industry was also threatened with paralysis because of the closure of the frontiers. The Cantons have just been forced to set aside a certain amount of wood for the paper mills, which will hereafter have to pay 32 francs per cubic meter for unbarked wood 10 centimeters and more in diameter delivered on the wagon.

While the war has brought about intensive utilization of the Swiss forests, foresters are also devoting considerable attention to the question of better forest management. In 1913 consumption exceeded

production by 700,000 cubic meters per year. Foresters have figured that this deficit could be wiped out by increasing the production of the 600,000 hectares of communal forest (67 per cent of all the Swiss forests) by 1.1 cubic meters per hectare per year. Foresters believe that this increase could be brought about if the forests were placed under the exclusive direction of technically trained men, who would see to it that proper thinnings were made, that formerly unused spaces were utilized, and that the stands were maintained in full production by the application of the appropriate silvicultural system, the selection system apparently being the most generally favored.

As an example of what can be done in the handling of communal forests the author cites the action of the Canton of Vaud. At the instigation of the Vaud Society of Foresters, the Canton Legislature in February, 1918, voted to reorganize the Forest Service. As a result of this reorganization the Cantonal Inspector now has a force of 20 local inspectors, each of whom is responsible for an area not exceeding 4,000 hectares, while previously there were only 11 such inspectors each responsible for an area comprising from 7,000 to 11,000 hectares. One of the first effects of this change will be to make possible the decennial revision of working plans for the federal and communal forests, which comprise respectively 4 per cent and 67 per cent of the total forest area of the Canton. The author emphasizes the fact that such revisions of working plans ought to be undertaken by foresters permanently in charge of the forest concerned rather than by foresters who visit the areas only occasionally for the specific purpose of revising the working plans. He expresses the hope that the example of Vaud may be followed by other Cantons throughout Switzerland, where the average acreage assigned to a forester now amounts to 8,579 hectares, which he considers altogether too large for even moderately intensive management.

The author concludes his paper with an expression of joy at the signing of the armistice and of regret that it will mean the departure of the French foresters who have been interned in Switzerland.

B. E. F.
S. T. D.

Chronique Suisse. A. Barbey. Revue des Eaux et Forêts, February, 1919, pp. 21-24.
Journal Forestier Suisse, Janvier, 1919, pp. 31-32.

MISCELLANEOUS

Forests in the War

The strategic importance of forests in the present war is pointed out in an interesting article by J. Demorlaine. He recognizes, of course, the value of the forests as producers of wood of all sorts for military purposes and the tactical importance of small bodies of woods as shelter for machine guns, observation posts, etc., but believes that the most important rôle of the forests in war is the protection afforded by continuous stands covering considerable areas. He points out that it was the great forests of Alsace, of the Vosges, and of Lorraine that enabled the French in 1914 to stop the advance of the German armies at the crest of the Vosges. It was the forests of Trois-Fontaine that enabled the French to save Saint-Dizier, an important nucleus of roads and railways. Paris, both in 1914 and in July, 1918, was saved by the forests of Villers-Cotterets and of Compiègne. In 1918 the retreat of the Germans was similarly favored by the great forests of the Ardennes and only the rapidity of the Allied offensive and the heroism of the Allied troops prevented the Germans from holding their ground in these forests much longer than they actually succeeded in doing.

M. Demorlaine closes his article with a plea that the devastated forests be left to recover themselves in peace. He advocates making the Germans repay the French in kind for the forest products which they have destroyed and which they have forced the French to use in their own defense. It is interesting to note that a special plea is made to do away for good with the intensive hunting which formerly used to be carried on in these forest regions. Military operations are said to have driven out the rodents which formerly infested the forests, and the author believes that they can be prevented from again becoming a pest if hunting is prohibited. S. T. D.

L. importance stratégique des forêts et la querre. J. Demorlaine. Revue des Eaux et Forêts, February, 1919, pp. 25-30.

EDITORIAL COMMENT

Why Not a Union for Foresters?

We believe that Mr. Leopold has touched upon a very vital problem in his article entitled "Forest Service Salaries and the Future of the National Forests," which appears in this issue of the Journal. In our judgment there is no doubt that the present low salaries for foresters, outside as well as inside the Forest Service, constitute a very real obstacle to the progress of forestry in this country, if they do not indeed endanger the results already secured. Inadequate compensation is further aggravated by lack of freedom for the development of initiative, lack of public support, lack of recognition by other scientific workers, and lack of opportunities for the practice of the profession. In addition to increased salaries, we need to place forestry on a higher plane scientifically, and to secure unquestioned acceptance of the necessity for forestry as an essential element in the national life.

In the consideration of ways and means to better the present situation we should like to suggest one addition to the remedies mentioned by Mr. Leopold. We heartily approve of the Federal Employees Unions and agree with him that they merit the support of every forester in the Forest Service. But are these unions enough? They are composed of employees of every grade, from charwoman to bureau chief; taken as a whole they are more interested in improving conditions for clerical than for technical workers; and their membership and field of activity are limited to the Government service. Would not the interests of foresters and other scientific workers, whether in public or private life, be served more effectively by an association organized along different lines?

Two examples that merit careful consideration in this connection are furnished by the American Association of University Professors and the recently organized British National Union for Scientific Workers. The objects of the latter include:

(1) To advance the interests of science—pure and applied—as an essential element in the national life; (2) to regulate the conditions of employment of persons with adequate scientific training and knowledge; and (3) to secure, in the interests of national efficiency, that all scientific and technical departments in the public service and all indus-

trial posts involving scientific knowledge shall be under the direct control of persons having adequate scientific training and knowledge.

Special objects deal with obtaining adequate endowment for research and advising as to the administration of such endowment, setting up an employment bureau and a register of trained scientific workers, and obtaining representation on the Whitley industrial councils. An applicant is qualified for membership if he or she has passed the examination leading to a university degree in science, technology, or mathematics and is engaged at the time of application on work of a required standard, though certain other qualifications are regarded as equivalent to university degrees and admitted in lieu thereof.

Do we not need some such unofficial, all-inclusive organization of scientific workers in the United States? Certainly foresters should find it an instrument of the greatest assistance, both in improving conditions of employment and in advancing the profession by placing its scientific work on a higher plane and securing increased recognition for it. An organization of this sort would do much to bring about a new feeling of comradeship among scientific workers; it would fix public attention on the importance of science in the national life; and it would wield an influence which no combination of workers in any one profession or group of professions could hope to equal.

We suggest that the President of the Society appoint a committee to consider the entire question from the standpoint of the foresters of the country. One of the first steps of such a committee would undoubtedly be to get in touch with the American Association of University Professors, the objects of which are similar to those of the British Union, and which might perhaps serve as a nucleus for a more inclusive organization. The latter would not, of course, interfere with the Federal Employees Unions, which cover a distinct field and have already demonstrated their usefulness.

The Need of State and National Quarantines to Prevent Rapid Spread of Chestnut Blight to Southern States

Recent inquiries have been made to the Office of Forest Pathology for information concerning the spread of the chestnut blight.

The chestnut blight may spread from infected regions to uninfected regions by natural agencies or through nursery shipments. It is this rapid spread southward through nursery-stock shipments that State and Federal legislation may prevent.

In December, 1917, the blight had already been found as far south

as Bedford County, Virginia, according to R. C. Jones,[1] the State Forester. Mr. Jones writes, "This disease is now quite prevalent in the northern part of Virginia, particularly in the Blue Ridge section, and has been found as far southwest as Bedford County. It is not at the present time known to occur at all south and west of Bedford County, but it appears to be spreading and will probably kill the chestnut trees throughout the State." Only a single county separates Bedford County from North Carolina.

South of Virginia, the chestnut blight has been reported from but two places: first, on July 10, 1913, when H. R. Fulton, the Plant Pathologist of the North Carolina Agricultural Experiment Station at West Raleigh, put out a Press Bulletin (No. 26) calling attention to the fact that the blight has been found in Guilford County. This was traced to a nursery and it had spread from the nursery trees to neighboring native chestnut trees in one woodlot. This infection was reported thoroughly cut out in early summer of 1913. Reports in the Plant Disease Survey at Washington for 1914 from North Carolina, however, show "continued spread in native chestnut and in nursery" in Guilford County. A later report to the Plant Disease Survey, dated 1916, shows blight present in small grove near Greensboro, only a few miles from Pomona, also in Guilford County.

The second case of blight is in South Carolina at Society Hill. On Christmas, 1914, J. T. Rogers of the Federal Horticultural Board, Washington, D. C., purchased several small paragon chestnut trees from the Van Lindley Nursery, Pomona, Guilford County, North Carolina, and planted them at his home at Society Hill, Darlington County, S. C., in the eastern part of the State. Mr. Rogers states that there is no native chestnut or any chestnut blight within a hundred miles of Society Hill. The disease seems to have incubated in these trees or to have escaped all notice for three years, for on December 31, 1917, he discovered the blight on one of these chestnut trees. A specimen collected from this tree a year later, December 31, 1918, has been positively identified by Dr. Neil Stevens of the Bureau of Plant Industry, as infected by the chestnut blight (*Endothia parasitica.*) None of the southern States, North Carolina, South Carolina, Kentucky, Tennessee, Alabama, or Georgia, which are all in the chestnut range, have adopted quarantine measures for preventing blighted chestnut nursery stock from coming into their States.

In Kentucky and Tennessee chestnut timber is quite a factor in the

[1] Jones, R. C.: Farm Forestry in Virginia, Bulletin No. 12, Virginia Geological Commission, Office of State Forester, pp. 54 and 55, December, 1917.

forest resources. The State Entomologist of Tennessee, Mr. George Bentley, has been approached regarding the advisability of establishing a quarantine preventing chestnut nursery stock being shipped into Tennessee from infected States, but as far as I know he has not taken any definite action. Mr. Maddox, Forester of Tennessee, writes that he is in favor of prevention of shipment of chestnut nursery stock from infected regions into the State. Tennessee, we know, has the power of establishing such a plant quarantine, as has North Carolina, Georgia, and Alabama. Kentucky, however, does not have power of quarantine, nor can it pass a law permitting the State Entomologist to declare a quarantine on any nursery stock until the General Assembly meets in 1920. Both Mr. H. Carman, State Entomologist, and Mr. Barton, State Forester, are desirous of having the Federal Government establish a quarantine to protect Kentucky from infected States. This has already been taken up with proper authorities.

California and Illinois have passed quarantine measures to prevent the chestnut blight from invading the States and infecting the small groves of planted chestnuts.

I inspected the stock of a nursery at Beatrice, Nebr., and found the blight present.[2] They had purchased the stock from a Pennsylvania nursery, and were acting as distributors to the whole country. The blight was also found on one of their shipments of chestnut trees in Lincoln, Nebr. Other nursery shipments of chestnut trees have been found diseased in California, Iowa, Indiana, Michigan, and Ohio, as well as in the generally infected States from Virginia northward.

One of the large distributors of nursery stock is located at Painesville, Ohio. The blight has been present in this nursery since 1914, yet the State does not prevent them from shipping chestnut trees to points outside the State. While the nursery does attempt to control the blight by frequent inspections and removal of visibly diseased trees, yet they miss many small infections. The State Entomologist of Indiana reported the blight on shipment of trees shipped from this nursery in 1915.

If foresters get back of a movement to have these Southern States, North Carolina, South Carolina, Georgia, Alabama, and Tennessee protected by State quarantines, and Kentucky by a Federal quarantine, the officials may act favorably and the blight will at least have been prevented from making long jumps on nursery shipments. These quarantines should be supplemented by adequate inspection of past shipments.

ROY G. PIERCE.

[2] Pierce, R. G.: Chestnut Blight in Nebraska. Phytopathology 5: 74, Feb., 1915.

NOTES

Forest Legislation in New York

At the meeting of the New York State Forestry Association, September 4, 1918, a committee was appointed to confer with similar committees representing other associations and institutions for the purpose of formulating a mutually acceptable forest taxation bill. This committee consists of Geo. N. Ostrander, as chairman, and Professors Baker, Hosmer, and Recknagel.

Profiting by last year's experience, when failure to agree on a satisfactory bill resulted in the Governor's veto of the bills which did pass, the committee decided to have all interests agree on a bill first before introducing it into the legislature.

Accordingly, suggestions were invited from all those interested, and on February 26 the conferees met in Albany to consider the revised bills as drafted by the committee. At this meeting these bills were approved, with certain modifications, and were thereupon introduced as companion bills in the Assembly by Mr. Everett, chairman of the Conservation Committee, on March 3 (Print Nos. 1051 and 1052, Intro. Nos. 951 and 952), and in the Senate by Mr. Kasson, member of the Conservation Committee, on March 17 (Print Nos. 1100 and 1101, Intro. Nos. 966 and 967).

The first of these bills amends the existing conservation law by substituting a new section 57 therein, to read as follows:

57. Classification of lands dedicated to continuous forest production. Lands of the area of fifty acres or upwards, which are unsuitable for agricultural purposes, may, in the discretion of the commission, be deemed to be dedicated to continuous forest production, and for the purpose of encouraging the growth of forest trees upon such lands the commission may, in its discretion, with the consent in writing of the owner thereof, classify such lands as lands dedicated to continuous forest production, and such lands shall thereafter be subject to the rules and regulations of the commission, failure to obey which shall be sufficient ground for the revocation of such classification by the commission. Such classification shall be certified by the commission and duplicate certificates thereof, under its seal, shall be filed with the comptroller and with the county treasurer of the county in which the lands or any part thereof are located, which certificate shall set forth a description of the lands, the area, the name of the owner thereof, the town in which the same are situated, and the certification that the land has been classified as land dedicated to continuous forest production. It shall be the duty of the county treasurer, upon its receipt, to file forthwith a certi-

fied copy of such certificate with the town clerk of each town in which all or any part of the lands described in such certificate are located. Application for such classification may be made by an owner of such lands, and shall be in the form and manner prescribed by the commission. Every owner of land classified as land dedicated to continuous forest production shall, not less than sixty days before the cutting of trees thereon for commercial purposes, notify the commission of the intended cutting and removal and, not less than thirty days before the removal of the product of such trees, shall report to it the amount in stumpage value of such trees. The commission may accept the report of the owner as to the amount and value of any such trees or in its discretion determine it from an independent inspection of the same. The commission shall assess, levy, and collect upon the gross stumpage value of any such trees, and the owner shall pay into the treasury of the State, upon the order of the commission and before the removal of such trees or of the product or products of such trees from the land, the following tax: if removed within ten years after classification, two percentum; more than ten and within fifteen years, four percentum; more than fifteen and within twenty years, six percentum; more than twenty and within twenty-five years, eight percentum; more than twenty-five and within thirty years, ten percentum; more than thirty and within forty years, twelve percentum; thereafter, fifteen percentum. Each such tax shall be a lien upon the lands and trees upon which it is levied from the time when it is payable until the same is paid in full, and the timber and timber products made therefrom shall be subject to lien for unpaid taxes and amounts payable under this act. Any timber products removed from said lands upon which the full amount of tax has not been paid shall be liable to seizure by the State wherever found, and after due notice may be sold to satisfy said unpaid taxes and the expenses of seizure and sale. In the event that lands classified hereunder shall, in the judgment of the commission, cease to be dedicated to continuous forest production, or that the forest growth thereon be destroyed by fire or by any other cause, or that the owner of such lands shall have violated any of the provisions of this article, or the regulations of the commission in respect thereto, or that the public interest demands it, the classification may be revoked by the commission. Such revocation shall be made by a certificate of the commission, under its seal, and shall be filed in the office of the comptroller and the county treasurer of the county in which the original certificate of classification shall have been filed. It shall be the duty of the county treasurer, upon its receipt, to forthwith file a certified copy of such certificate with the town clerk of each town in which all or any part of the lands described in the certificate are located.

Land classified under this article may be withdrawn from classification by the owner at any time, upon giving sixty days' notice in writing to that effect to the commission and upon payment into the treasury of the State of the sums hereinafter provided for. In the event that the classification of lands hereunder shall be revoked or that they are withdrawn from classification by the owner, the owner of any such lands shall pay into the treasury of the State, upon the order of the commission, if such revocation or withdrawal is made within ten years after the date of classification, an amount equal to the amount of taxes with interest thereon at the rate of six percentum per annum, which may have been paid out of the treasury of the State or credited by the comptroller to the county treasurer for taxes upon the trees upon such lands under the provisions of the

tax law and such amount shall be and remain a lien upon the lands of the owner until payment shall have been made, and shall be collectable in the same manner as unpaid taxes, pursuant to the provisions of the tax law. Should such revocation or withdrawal be made more than ten years after the date of classification, the owner shall pay into the treasury of the State, upon the order of the commission, the rate tax prescribed herein upon the gross stumpage value of the trees then standing upon such land, as though the trees had then been cut; or if said trees have been destroyed or injured by fire since classification, then the same rate tax on any stumpage value remaining and on any insurance which the owner may receive therefor to be collected in a civil action. Upon any such revocation or receipt of notice in writing of the desire of the owner to withdraw land from classification, the commission shall, if such revocation be made or such notice be received within ten years from the date of the classification of the lands, give the owner a statement of the amount due the State for taxes.

The second bill amends the tax law and provides that land so classified will be assessed and taxed separately from the growing trees thereon and at the same valuation and rate as are lands and real property of the same quality and similarly located. The growing trees on the land are assessed and taxed at the same valuation and rate as is other real property of the same character.

The tax assessors, by August 1 of each year, file a copy of the assessment roll with the Conservation Commission. By September 1 the Conservation Commission must hear all complaints, advise the assessors regarding unfair or excessive assessments, and return the approved roll to the assessors.

During the period of exemption, the taxes upon growing trees on land duly classified are credited to the treasurer of the respective county, and, in case it exceeds the State tax in such county, the comptroller pays the balance to the county treasurer. The comptroller is authorized to pass upon the correctness of the county treasurer's statement of all taxes assessed upon such original assessment roll upon growing trees upon lands classified as forest lands dedicated to continuous forest production.

In their present form these bills represent a consensus of opinion and have the approval of the Association for the Protection of the Adirondacks, the Camp Fire Club of America, the Conservation Commission, Cornell University, the Empire State Forest Products Association, the New York State College of Forestry, and the New York State Forestry Association. This would seem to insure their passage and enactment into law.

New York will have taken another big stride forward in encouraging reforestation of private land if Assembly Bill No. 1459 becomes

law. This bill, introduced by Mr. Everett, is the result of joint effort by the Empire State Forest Products Association and the Conservation Commission. It provides that—

"The commission may agree with the owner of non-agricultural land, of the area of not less than fifty acres, which is in need of reforestation, to provide for the reforesting of such land under such safeguards as the commission deems necessary to insure the establishment and proper protection of such a plantation, and may furnish trees from any of the nurseries operated by such commission, without charge at the nursery, providing the owner of the land will agree that the land shall be held for continuous forest production and that no trees so planted shall be cut, except in accordance with the regulations of the commission. Such agreement shall be recorded in the office of the county clerk of the county where the land is situated, and the provisions thereof shall be deemed to be and be covenants running with the land."

The sum of $25,000 is appropriated as a starter, but it is realized that many times this amount may be needed in the future; for there are probably 276,000 acres of privately owned, non-agricultural land in the Adirondacks alone in need of planting.

As an incentive to private forest management, this measure, coupled with the pending forest tax bills providing for deferred taxation until the crop is cut, marks a wise policy of encouraging private forest owners to practice forestry by making it economically attractive.

A. B. RECKNAGEL.

Annual Meeting of the National Wholesale Lumber Dealers' Association

At the twenty-seventh annual meeting of the National Wholesale Lumber Dealers' Association, in Philadelphia, March 19 and 20, J. Randall Williams, Jr., chairman of the Forestry Committee, made a report, the summary of which was as follows:

"Your Committee on Forestry: First, calls your attention to the wonderful work done by our American woodsmen and lumbermen toward winning the great world war. Second, heartily endorses the plan of the American Forestry Association to reforest the war-devastated countries abroad, and to plant memorial trees as a living tribute to those who have died for us. Third, we urge greater appropriations by the States for forest fire protection. Fourth, we recommend the Federal assistance in control of cut-over lands. Fifth, we recommend private ownership of standing timber."

The following resolution on forestry was adopted by the same convention and is of particular interest in view of the movement inaugurated by the Forest Service to secure the adoption of a permanent timberland policy for the United States:

"*Whereas* the forestry measures now in effect in this country are recognized to be inadequate to guarantee the timber supply which the nation in the future will require.

"*Resolved,* That the National Wholesale Lumber Dealers' Association believes that the time is here when a national program of forestry should be constructed and set up to express the aims toward which the nation should work in timber and forestry matters, and to direct and stimulate the Federal Government, the States, and the owners of timber and forest lands in practical lines of activity. The association hereby pledges its active aid in the formulation of a program of this kind and authorizes its officers to take the necessary steps to co-operate with the Federal Government, the States, and timber and forest landowners and lumber manufacturers' associations and the National Chamber of Commerce."

Poison for Killing Trees

In the Weekly News Letter of the U. S. Department of Agriculture for February 19 there appears an interesting note on arsenic as an effective poison for killing trees.

In cleaning up pasture land or clearing new land for crops, it is often desirable to kill trees by some method surer and quicker than the old-time method of girdling. In dealing with the kinds of trees which sprout from the stump, such as the oaks, hickories, and red gum, a reliable method of killing is especially needed.

For the purpose of poisoning trees, arsenic has been successfully used in both this and other countries, often killing trees in a few weeks or a few days which, by the simple girdling process, would require months. Useful directions for making up a poison solution for quick and effective work in all kinds of timber, together with the method of application, are given below, quoted from a recent number of the Australia Forestry Journal. In Australia, it appears, much investigation has been carried on, and this method has been widely used with excellent results. Following is the formula:

Arsenic, 1 pound; washing soda, 1 pound, or caustic soda, ½ pound; whiting, ½ pound; water, 4 gallons.

Since the ordinary white arsenious oxide of commerce is not soluble in water to any great degree, soda has to be used for the purpose. When large amounts of the poison are desired, washing soda will be cheaper, but for small amounts caustic soda will perhaps be found the handiest.

To prepare the solution, first dissolve the soda (either form) in a convenient amount of water, using heat, if desirable, to assist and hasten it; then slowly add the arsenic, previously made into a thin paste (as the housewife treats her corn flour), stirring all the time;

place on a strong fire, and after it has come to the boil, allow it to remain boiling for at least half an hour; stir from time to time, and be careful to stand on the side away from the fumes, as, being poisonous, they are apt to cause sickness. When the arsenic is thoroughly dissolved, the solution may be made up to the required bulk by adding the remainder of the water, either hot or cold. The whiting is added merely to serve as an indicator of the trees treated, as it turns white on drying.

The best time for carrying on the operation of poisoning is when the tree is dormant, or during the winter months. This will most surely prevent suckering, although trees can be killed practically any time of the year.

In applying the poison, the tree is first girdled by a series of heavy downward strokes of the ax through the bark and well into the wood, leaving the chips protruding outward in a "frill" extending completely around the tree. It is necessary that this "frilling" process be thoroughly done, which alone would ordinarily kill the tree after some time. A half pint for small trees to a quart for very large trees of the poison is then poured into the chipped surface, taking care to saturate the wood thoroughly. An old teapot or kettle with a spout serves well the purpose of pouring without needless waste or spilling down the tree. Suplings may be cut off low down and the poison applied over the stump by a swab stick. If this is done when the sap is down the tree will be completely killed and suckering prevented.

Arbor Day

Observance of Arbor Day by the planting of trees dedicated to those whose lives were sacrificed in the war is advocated by the Secretary of Agriculture in a letter to the governors of the States, as follows:

"The observance of Arbor Day began soon after the Civil War. A distinguished citizen of Nebraska, who later became Secretary of Agriculture, was the prime mover in securing its recognition within his State, where it first took root; and the Board of Agriculture of that State, on his motion, designated the first Arbor Day. From the beginning it has had a civic motive and an association of patriotism.

"Another and greater war has come to its inevitable conclusion. The cause of righteousness, of liberty, of all that Americans hold dear, has prevailed. We shall seek many ways to perpetuate the memory of those who made the great sacrifice. The memorials will take many forms. The names of those who have fallen will be perpetuated by costly monuments and inscribed on enduring tablets. Great works that serve the needs of peace also will doubtless be dedicated to them.

"But along with these memorials we can easily discover ways in which we may

simply and spontaneously pay our tribute to them. We can keep fresh our memory of what they gave, and we can perpetuate their names in familiar places. It has been happily suggested that we may do this by adorning with young trees, each named for a fallen soldier, our waysides, our yards, and our pleasure places. And in most of our States Arbor Day is at hand. This year we may give to that day a meaning more profound, a purpose more exalted, yet also an association more personal.

"I conceive that, if the origin of the day be borne in mind, the invitation to our fellow-citizens to join in making it a day 'especially set apart and consecrated for tree planting' may appropriately come from this department. I take the liberty, therefore, of suggesting that you commend to the citizens of your State, and particularly to those in attendance upon its schools, such as an observance of Arbor Day as will secure a widespread planting of trees, dedicated to those whose lives have been sacrificed in the great struggle to preserve American rights and the civilization of the world."

Forestry Legislation in Michigan

The planting of ornamental and memorial trees along the highways in Michigan, under the direction of the forestry department of the Michigan Agricultural College, is provided for in a bill recently introduced in the State legislature. Another bill provides for the extension of the territory under the jurisdiction of the forest fire department to include such areas in eleven counties of the States as may need forest fire protection. This action is taken because of the need of protection for the young stands and cut-over timberlands in those counties. If this bill is passed it will extend the region under the jurisdiction of the department considerably. An amendment in the forest-fire law is proposed which will require that persons setting fire for the purpose of clearing land between April 1 and December 1 must first obtain a permit from the State Game, Fish, and Forest Fire Commission, or from a deputy, or from supervisors of the township, when and wherever contiguous timber, slash, debris, or other combustible material liable to ignition exists on land adjoining that which is being cleared. Failure to do so is made a misdemeanor and punishable on conviction by a fine of not less than $5 nor more than $100, or by imprisonment in the county jail for thirty days, or by both fine and imprisonment. It is hoped that this will make the present law effective.

Yellow Pine in Michigan

The plantations of western yellow pine (*Pinus ponderosa*) which have been made in different localities upon the plains region of Michigan show varying results for this species. The growth of stock planted

by the State in Roscommon County, by the Government in Iosco County, and by private individuals at Indian Lake and Tawas Beach near East Tawas is very slow, the trees taking on a scraggly, bushy form, and are also frequently winter-killed. The trees are also affected by the Peridermium, which is native on jack pine (*Pinus banksianna*), and the State Forester found it necessary to dig up all the yellow pine which had been planted, because of this injury. A plantation made upon the Schmidt farm near Oscoda has, however, been very successful. These trees were planted as 2-1 stock in 1913 and are now growing very thriftily. The soil of this particular site is a light sand mixed with varying proportions of fine gravel, which is damp for the majority of the time except for the topmost soil.

Pennsylvania State Forest Statistics

The following statistics are taken from *Forest Leaves*, February, 1919, p. 16:

Total area, 1,029,023 acres.

Total cost of land, $2,342,918.62.

Average cost per acre, $2.27.

Number divisions known as State Forests, 53.

Amount expended to January 1, 1918, other than for lands, $5,339,946.29.

Number of foresters in service before the war, 68.

Number of rangers in service before the war, 93.

Number of foresters now in service, 30.

Number of rangers now in service, 89.

Number of foresters now on State Forests, 26.

Number of district foresters, 3; two of them also have forests.

Total receipts from State Forests to January 1, 1918, $147,713.82, of which three-fifths is for timber sales.

Receipts for 1916, $21,459.97; for 1917, $21,569.69; to November 15, 1918, $19,-382.02.

Number leased camps, 417.

Number temporary camps, 384; persons using same, 1,989.

Buildings erected: steel towers on State Forests, 9; wood towers, 39; tree towers, 92.

Miles of telephone lines built or owned by Department, 292.

Miles of roads built, brushed, or repaired by Department, 3,500.

Miles of boundary lines surveyed and brushed, over 2,000.

Acres surveyed topographically and mapped out, about 300,000.

Trees planted on State Forests, 31,534,556.

Acres reforested, 19,425.

Acres of nurseries, 25.

Seedlings available for 1919 planting, about 9,500,000.

Seedlings given to private planters, about 5,000,000.

Present value of State Forest property:

300,000 acres of land at $20	$6,000,000
300,000 acres of land at 10	3,000,000
100,000 acres of land at 5	500,000
329,000 acres of land at 2	658,000
Buildings, telephones, and towers	325,000
Tools, equipment, maps, livestock, vehicles	92,000
	$10,575,000

At a recent meeting of the Board of Regents of the University of Washington, the name of the College of Forestry was changed to College of Forestry and Lumbering. While the term forestry, when viewed in its broadest sense, embraces lumbering, the work at the University of Washington has broadened out so as to cover practically every phase of the lumbering industry, and in this respect differs from practically all other forest schools. In addition to the work ordinarily covered in the forestry curriculum, Washington offers opportunities for specialization in general forest products, logging engineering, and the business of lumbering, the latter including new courses in milling and marketing. Expansion along these lines was necessary to meet the needs of the industry in the Pacific Northwest. The courses in logging, engineering, and forest products have now become thoroughly established and won recognition in the industry to the extent that the demand for the graduates, particularly in logging engineering, has far exceeded the supply. It is expected that the same will be true in the course covering the business of lumbering as soon as this becomes well established.

The American overseas army will soon find forestry exhibits in some of the Y. M. C. A. huts in France. Four special collections of models, bromides, etc., have been made up as part of the Department of Agriculture exhibits to be shown in co-operation with the Y. M. C. A., and these are being loaded on the steamer this week. C. A. Lindstrom is the Forest Service representative and will be in charge of one of the four circuits to be covered by the Department exhibits. The purpose of the work is to help in the back-to-the-soil movement and to give the soldiers an opportunity to learn something of the various phases of farming and forestry. The Forest Service exhibits show farm forestry, fire protection, erosion, windbreaks, and post treating.

M. Thiéry, one of the best known of French foresters, died on November 16, 1918, at the age of 77. Some 33 years of his life were devoted to teaching at the National School of Waters and Forests at

Nancy, where he was greatly beloved. He was especially interested in applied mathematics and in the restoration of a forest cover in the mountains. While he wrote several treatises on mathematics and topographical surveying, he is especially well known in this country for his work on the restoration of the mountains, correction of torrents, and reforestation. He was retired from active service in 1911, but retained his physical and intellectual powers and continued to take a keen interest in the work of the profession until his death.

Eighty acres of virgin soil, much of it covered with timber, has been offered Michigan City, Indiana, for a war memorial park by Martin T. Krueger, former Mayor of the city. The proposal was made to the Chamber of Commerce of the city, and was unanimously accepted. In writing of the park former Mayor Krueger said: "This land is beautifully located; its virgin soil has never been touched by spade or plow, and is covered by a growth of white pine, white, red and yellow oak, maple, sycamore, poplar, cherry, elm, and basswood, and thickly set in spots with flowering shrubs, as dogwood and witch-hazel, and festooned with great spreading and sprawling grapevines. The land is rolling, well drained and free from every objectionable growth or feature."

Egypt produces rice straw, papyrus, and other fibers which might well serve for the manufacture of paper. Experiments have been made with rice straw, and one variety of papyrus, called Bourdy, which grows on a large scale in the lake district of the Delta. No useful result has been obtained with the latter, which it appears does not possesss the qualities necessary for paper making. As regards rice straw, the experiments have been more satisfactory, and some good, practical results might be obtained. Egypt imported before the war annually about 25,000 tons of paper of all varieties. The quantity of rice-straw available is very considerable, some 250,000 to 300,000 feddans, producing 350,000 tons of rice, are annually cultivated, but the whole question is a highly technical one and requires very deep and extensive inquiry. It is understood that the matter is receiving the close attention of the Anglo-Egyptian authorities in all its aspects. There already exists a paper factory in Alexandria.

The new wood-testing laboratory of British Columbia, housed in a specially constructed building at the Provincial University, is now in operation. L. L. Brown, a former member of the Forest Products Lab-

oratory staff at McGill University, being in charge, with several assistant. The laboratory was primarily established as a war measure for the testing of airplane spruce at the place of production. The laboratory staff at McGill having almost been depleted, owing to the war, an arrangement was made to ship its entire equipment to British Columbia, thus advancing the work by the many months it would have taken to secure new machinery. If it is decided to discontinue the test of spruce, the laboratory will make a comprehensive study of Douglas fir in structural dimensions. The tests made at the laboratory cover bending, impact bending, compression parallel to grain, compression perpendicular to grain, hardness, shearing parallel to grain, cleavage, tension perpendicular to grain, etc.

Abraham Gustaf Theodor De Broen, the dean of Swedish foresters, died on December 7, 1918, at the age of 88. His work was for the most part in the southern part of Sweden, not far from Stockholm, in one of the most productive regions in the country. He was especially noted for his success in securing satisfactory reproduction, both natural and artificial, and in this respect is said to be equalled by few Swedish foresters of the present day. He did not, however, appreciate the importance of cultural measures in the stand after its establishment, and once remarked to the Director of the Swedish State Forest Experiment Station, in regard to a sample plot that had been thinned three times in 12 years, that if he continued much further in that way he would have nothing left but a stand of seed trees. De Broen was unusually fond of the chase and was famed as a mighty hunter of great physical prowess.

The Reliance Lumber Company, of Seattle, was tried in the U. S. District Court for the Western District of Washington this spring for a fire trespass in 1917, starting from a donkey engine crossing from private lands over the Rainier National Forest boundary. The court rendered a verdict in favor of the Government of $685.87, the cost of fighting this fire and putting it under control, there being some conflict of testimony as to the real value of the timber and undergrowth destroyed (valued at $248.91) and whether they were both actually destroyed by this fire.

The Massachusetts Forestry Association has issued a pamphlet "The National Parks and Forests," giving outline of another tour to take place under their auspices June to September, 1919; business manager,

Travel Department of the American Express, New York City. The purpose of the tour is primarily educational. The itinerary will in general be a duplication of that of 1917, a choice of nine tours, varying in length from 25 to 58 days, being given. Start may be made from either Boston or Chicago, and the trip will include: Denver, Estes Park, Yellowstone, Glacier Park, Seattle, Mt. Rainier, Portland, Crater Lake, Klamath Lake, San Francisco, Yosemite, Los Angeles, San Diego, Riverside, Grand Canyon, with an extension, similar to that given in the previous tour, through Tusayan and Coconino National Forests.

Paper soles can be made just as durable and waterproof as the best leather soles by the following process: Soak about 30 sheets of paper in oil of turpentine, and then glue together with the following composition: oil of turpentine, Spanish wire, resinous lac, and linseed oil, to which some litharge or protoxide of lead has been added. After being glued together, the packet of paper sheets is put under strong pressure, by which means a strong sheet of cardboard is obtained. The sheet is smoothed and trimmed, and then cut to shape, and makes an excellent substitute for a leather sole.

Ranger Walter Jones, of the Siskiyou National Forest, has devised an eye protector for the use of lookouts. The device is simple. It is made of cardboard, painted black, fitting over the eyes, and has a long horizontal opening lined with narrow strips which prevent the entrance of light from the sides, also from above and below. A test will be made by several lookouts. Ranger Jones states that his device will successfully protect the eyes against the bright glare in the atmosphere at high elevations.

Cascara bark stumpage on 800 acres in the Siuslaw is being advertised. It is estimated that the yield will aggregate 20,000 pounds of dry cascara bark. The upset price is three cents, being based on the current price paid last year on several small scales. Pealing of cascara bark is a home industry on the Siuslaw and is as a rule done by the settler, with the help of members of his family. Many small sales aggregating thousands of pounds, are made annually on the Siuslaw.

A writer in the *Revue des Eaux et Forêts* for February, 1919, advocates the greatly increased use of automobiles as a means of building up the population in the country and in the forests. In his judgment

the State should take the lead in supplying cheap machines to forest workers as a means of increasing their efficiency and improving their living conditions.

The manufacture of shoes in Germany from substitutes for leather, among which wood is the chief material used, has become an important industry. Twenty-five large firms now manufacture such shoes with an estimated capacity of 100 million pairs per year. Beech is the principal species used, but all hardwoods, except oak, are utilized.

Carrier pigeons used in fire protection on the Forests in Oregon and Washington is the latest. Forest Examiner W. J. Sproat will inaugurate the experiment on the Deschutes Forest. He has five pairs of birds. Similar experiments will be tried on the Cascade. The plan is to use the pigeons as a means of communication in emergencies and for carrying fire reports.

Last year, according to the report of C. J. Hall, Superintendent of the Provincial Forest Protection Service, there were 430 forest fires in Quebec, which devastated 23 square miles of forest out of 48,800,000 square miles, operated for forestry work, the total damage amounting to only $5,557. The splendid results achieved are attributed largely to the efficiency of the work of the private fire protective associations.

On December 28, 1918, the Academy of Moral and Political Sciences awarded a prize of 1,500 francs to M. Fabre, Inspector of Waters and Forests and Vice-President of the Academy of Sciences, Arts, and Belles-Lettres of Dijon, for his collection of "economic and sociological studies in the high French mountains."

Prof. Raymond J. Becraft, formerly with the Forest Service, has been placed in charge of the department of range management just established by the Utah Agricultural Experiment Station. One of the first undertakings of the department will be to increase the carrying capacity of Utah ranges by scientific management.

SOCIETY AFFAIRS

Report of the Treasurer for the Year 1918

The outstanding feature of this statement is the excess of assets over liabilities of $1,017.32, as compared with $690.48 for the previous year and $581.15 for 1916. The factors which have contributed to this greater balance are: an increased number of members, an increase in the advertising receipts, and the larger balance brought forward on January 1, 1918, over the previous year.

It will be noticed that the figure given for the publication and distribution of the Journal ($3,089.30) includes $328.80 paid for the last issue of the preceding volume. This, however, is just about offset by the expense of the last number for this year.

In spite of the increased cost of printing and the large size of a few of the numbers, the average cost per copy has been about the same as for the previous year, or 32 cents a copy as compared to 34 cents last year.

The business of the Society has grown so considerably since the combination of the *Forestry Quarterly* and the *Proceedings* that an increasing amount of time has been necessary to handle the bookkeeping, the collection of bills, etc. In view of the frequent change of treasurers, it has been thought best to have all of this work handled by one person, who might be continued from year to year at the will of subsequent treasurers. The Society has been fortunate in securing the services of Miss Helen E. Stockbridge for this work.

Although the excess of assets over liabilities is encouraging, it is very desirable that this balance should be further increased by the addition of new subscriptions to the Journal and the placing of additional advertising. More money should be appropriated for bringing the magazine to the attention of libraries and industries which might be interested in advertising.

An estimate of receipts during 1919 follows:

Annual dues, 350 at $5.00	$1,750.00
Subscriptions, 600 at $3.00	1,800.00
Sale of back numbers and separates	100.00
Advertising	200.00
Interest on bank deposit	25.00
	$3,875.00

RECEIPTS

Balance on hand January 1, 1918				$1,277.83
Annual dues, active members:				
1917		$7.50		
1918		1,567.20		
1919		761.00		
			$2,335.70	
Subscriptions to JOURNAL:				
1917, Vol. 15		$0.70		
1918, Vol. 16:				
Student	$12.00			
Regular	1,529.82			
		1,541.82		
1919, Vol. 17		443.20		
1920, Vol. 18		4.00		
			1,989.72	
Sale of back numbers and separates:				
JOURNAL		$39.00		
Proceedings		28.25		
Forestry Quarterly		45.75		
Separates		23.50		
			136.50	
Advertising:				
By commercial institutions		$102.50		
By educational institutions		93.75		
			196.25	
Society pins			17.52	
Miscellaneous:				
Interest from bank, July, 1917, to Dec., 1918		$45.80		
Assessments due Washington Section		6.00		
Refund for two half-tone illustrations		5.00		
Bank deposit not accounted for in 1917		5.00		
			62.80	
Total				4,738.49
Grand total				$6,016.32

DISBURSEMENTS

Publication and distribution of JOURNAL:				
Printing—				
Vol 15, No. 8	$328.80			
Vol 16, Nos. 1 to 7	2,356.67			
		$2,685.47		
Plates and line cuts		70.95		
Proof-reading		120.00		
Envelopes for mailing		101.15		
Address stencils		5.36		
Ribbon for addressing machine		.75		
Mailing		20.00		
Postage		85.62		
			$3,089.30	
Miscellaneous printing:				
Circulars and ballots			27.38	
Stationery:				
Letter-heads		$1.25		
Postcards		3.25		
Envelopes (window)		11.70		

Envelopes (letter)		3.07		
Index cards		8.20		
Billheads		29.50		
			56.97	
Postage (exclusive of JOURNAL)			100.90	
Clerical work and typewriting			136.00	
Addressing notices, envelopes, etc			11.29	
Express			1.84	
Society pins			17.52	
Miscellaneous:				
Refund to Washington Section		$6.00		
Refund on canceled subscriptions		8.50		
Reprints (constitution and members)		10.00		
Reprints (Forest terminology, Pt. 2)		32.50		
			57.00	
Total				$3,498.20
Balance on hand				2,518.12
Grand total				$6,016.32

ASSETS

Balance on hand	$2,518.12	
Annual dues (17 members at $5.00)	85.00	
Sale of back numbers and separates	16.00	
Advertising	42.25	
Postal deposit	6.75	
Total		2,668.12

LIABILITIES

Annual dues paid in advance			$761.00	
Subscriptions to JOURNAL:				
1919, Vol. 17		$443.20		
1920, Vol. 18		4.00		
			447.20	
JOURNAL OF FORESTRY, Vol. 16. No. 8:				
Printing		$337.45		
Distribution		9.65		
Proof-reading:				
No. 7	$20.00			
No. 8	20.00			
		40.00		
			387.10	
Clerical work and typewriting			22.25	
Dr. Fernow (Quarterlies sold in 1918)			26.75	
Miscellaneous printing			6.50	
Total				$1,650.80
Excess of assets over liabilities				$1,017.32

Audited and found correct by W. B. Barrows.

A. F. HAWES,
Treasurer.

Hubert C. Williams

In the death of First Lieutenant Hubert C. Williams, Co. D, 30th Engineers, who gave his life for his country on the battlefields of France (wounded September 10; died September 13, 1918), those interested in the cause of forestry lost a fellow-worker deeply imbued with faith in the principles underlying his chosen profession. But while his loss will be keenly felt in the ranks of the professional foresters, both in and out of the Forest Service, the deepest sorrow, the greatest feeling of personal loss and lasting remembrance of his real friendship, will be shared by the lonely prospector, the trapper, and the isolated homesteader in the great mountain wilderness of central Idaho. There, as supervisor of the Idaho National Forest, Mr. Williams was known among those stern judges of human character as a man among men, a friend of friends. His clean, moral standards, great physical strength and feats of endurance, willingness to always assume more than his share of the burden, and his charming personality created a love and respect for the man in the hearts of these mountain folk that will live beyond the present generation.

Mr. Williams graduated from Sheffield Scientific School, Yale University, in 1906. In the fall of the same year he entered the Yale Forest School, graduating in 1908 with the degree of Master of Forestry. Following graduation he worked from July, 1908, to 1910 for the Goodman Lumber Company of Goodman, Wisconsin. While in this position he was the first postmaster of Goodman. From April until December, 1913, he was in the employ of the Cascade Lumber Company at Cle Elum, Washington, and from December, 1913, until April, 1914, was employed by Vitale & Rothery, cruising and mapping timber in Quebec on the holdings of the McLarsen Lumber Company.

Mr. Williams entered the Forest Service May 8, 1911, as forest assistant. On November 16, 1912, he was promoted to deputy forest supervisor, and served in this position until April, 1913, when he resigned to accept a position with the Cascade Lumber Company. During this period he was employed on the Idaho National Forest. On April 15, 1914, he was reinstated in the Forest Service and assigned to the Payette National Forest, in charge of a crew detailed to estimate and appraise 100,000,000 feet of National Forest timber. On July 1, 1915, he assumed charge of the Wasatch National Forest as acting supervisor, and on June 2, 1916, was transferred to the Idaho National Forest, where he served in the capacity of forest supervisor until March 31, 1917.

Mr. Williams was elected to senior membership in the Society of American Foresters, April 26, 1916.

As an officer of the Forest Service, Mr. Williams held the utmost confidence and respect of both superiors and subordinates and his loss to the Government will be as keenly felt as his departure from the communities which he served in the Idaho region.

Ernest C. Rogers

In the death of Ernest C. Rogers the Society of American Foresters has lost a most loyal and capable member. From the time he entered the Forest Service, in 1913, until his death, in Washington, on February 11, Rogers had been engaged in reforestation research. He began his work at the Priest River Experiment Station with but few plans and precedents in American practice in forestation investigations. The practice now used and the thoroughgoing plans for investigations bear the marks of his early influence. He always stood firmly for a policy of thoroughgoing investigation of fundamental facts, even though it entailed the postponement of other urgent problems.

A thorough and investigative student of research problems, he gave largely of his time and money to improve his knowledge of the various subjects bearing on reforestation. Having a working knowledge of French, German, and Scandinavian languages, he followed closely the forestation systems in those countries and adopted the knowledge so obtained to his own work. He was a graduate of the University of Minnesota, obtaining the degree of A. M. from Cornell University, and had nearly completed a course of study in plant physiology in Johns Hopkins University leading to the degree of Ph. D. At the time of his death he was engaged at Washington, D. C., in making a bibliography of European literature on forestation subjects. He had under way numerous research problems at the Savenac Nursery, Haugan, Montana; unfortunately, very little of his work had been completed at the time of his death. His modesty was perhaps responsible for the small amount of work published as the result of his studies. He was the author of two articles recently submitted to the JOURNAL OF FORESTRY—"A Preliminary Field Test of Age Classes of Western White Pine Planting Stock" and "Influence of Season of Transplanting Western White Pine Seedlings upon their Behavior in Nursery and Plantation."

It may be said of Rogers that he had laid the cornerstone for the building of a career which would have been most fruitful of results in forestry had he not been prematurely called by death.

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JOURNAL OF FORESTRY

VOL. XVII MAY, 1919 NO. 5

A PLEA FOR ASSERTION

BY FREDERICK E. OLMSTED

It is apparent that foresters are in for a struggle if forestry is to be something more than a thing talked about. It will be no more than that until privately owned timberlands in this country are kept productive. There is now ample evidence to show that we are entering upon a period of real national accomplishment, and that the country will welcome a definite constructive program aimed at the practice of forestry *in the woods*.

Let me beg that we assert ourselves. First, we must agree among ourselves as to what should be done and how to do it. We must not argue only; we must grapple with the problem from the ground up. For the past ten years we have acted as if we were afraid of our souls, declaring ourselves timorously or not at all. Let us not be diverted from our course by an opposition which cries for facts involving long years of research. We already have such facts as are necessary to show that our forests are being destroyed, that it is a practicable matter to keep them reasonably productive, and that it is vital to the welfare of the country, both regionally and as a whole, that its forests should not be destroyed. Therefore, why not begin to apply forestry throughout our principal forest regions? Let us, without question, enter upon a program of thoroughgoing and well co-ordinated research in order that we may know precisely how best to handle each forest type in years to come, to the end that the greatest and most desirable yields of wood may be obtained; but let us not confuse the need for research with the need for immediate action of an economic and political nature. If we should become unduly immersed in research, it might happen that by the time our investigative work was concluded we should find ourselves without forests upon which to apply our findings.

Let us affirm what we already know. The profession of forestry in this country has been kept upon a particularly high, clean plane, and will bear strict comparison with any other of the leading professions. For the past twenty years we have worked with good results in many different fields of endeavor and have accumulated technical, economic and political knowledge of distinct value. We have failed, however, properly to assemble this knowledge, rightly to place it before the public, and energetically to put it to practical use. Let us, by all means, secure co-operation in our work from all possible sources; but let us not forget that co-operation which is worth anything, real rather than lip co-operation, will come only after we have fought for and created it.

We lack aggressiveness, not confidence. Let us change our passive attitude to one of vigorous assertion.

PRESENT STATUS OF FOREST TAXATION IN THE UNITED STATES

By M. K. McKay, Ph. D.

Department of Economics, New Hampshire College

INTRODUCTION

That the development of the relation between forestry and taxation has not, in most of our States, received the attention at the hands of legislators which it so justly and so urgently deserves still remains true. Economists and those conversant in matters of taxation, and indeed the rank and file in general, are cognizant of the fact that the relationship between the taxation and the proper development and conservation of forests is a very significant one. In spite of this knowledge and in spite of the reports of many special commissions appointed to investigate the subject, the majority of our States continue to tax forest property in the same manner as other property is taxed, giving little or no attention to its peculiar and inherent characteristics.

Fair and equitable treatment of timber property in matters of taxation involves many difficulties, perhaps more than in the case of any other natural resource. Here both development and subsequent conservation are closely associated with taxation. Most of the Commonwealths continue to use the general property tax in making levies upon forest property. This practice (by those conversant with the problems of taxation) is known to be wrong and can be defended neither in theory nor in practice. Its defects are too well known to need lengthy comment in this article. Prof. Fred R. Fairchild, of Yale University, one of the leading authorities in forest taxation, has this to say regarding the general property tax as applied to forests: "A property tax strictly enforced must inevitably place an excessive burden upon forests as compared with ordinary investments yielding a regular annual income. It might easily take away from one-third to one-half of the entire income and very much more under certain conditions. This answers what the law clearly requires: that the forests be taxed each year on their true value, land and timber together. Forestry should not be subjected to such an unjust burden."

There would appear to be no injustice in taxing forest lands as other

unimproved lands are taxed. To the writer, it is clear that the tax on the timber growth should be based on a value approximating at least the annual increase. As far as possible, therefore, the taxes should be collected as near to the time the crop is harvested as can be conveniently done. In other words, the tax should be collected when the timber is cut. To the extent that this is done, we will be acting in conformity with Adam Smith's well-known canon of taxation: "Every tax ought to be levied at the time, or in the manner, in which it is most likely to be convenient for the contributor to pay it." The levy on the cut, we believe, should be the principal tax, but it should not be the only tax levy made. If the levy on the cut were the only tax, the result would be that many valuable lands would be exempted, and therefore land speculation rather than timber culture would be encouraged. If the tax on the crop when harvested were the only levy made, lands which are more valuable for other purposes, such as agricultural, might be held for forestry. Again, if such a method of taxation were introduced, many localities would be robbed of a considerable amount of revenue, which would either have to be made good through higher levies on other kinds of property or the State would have to make good the deficit, depending possibly upon subsequent reimbursement when the tax is collected on the cut.[1] Such a plan does not appear best or even advisable. However, when States reserve lands for forest purposes, the practice is sometimes adopted of paying annually certain specified sums to the local communities. Thus the State of Pennsylvania, which owns about 1,000,000 acres of forest reserves, pays to the local divisions in which the lands are located two cents per acre for school and two cents per acre for county or road purposes.

To the writer, the only logical and equitable course to pursue in regard to the taxation of forests, especially commercial forests as distinguished from farm forests, is to treat them as business propositions requiring no special favors. This class of property is capable of bearing a portion of the financial burden and should be taxed. It should be treated, however, in accordance with the inherent facts and conditions. Those engaged in commercial forestry should not be considered objects of charity nor should they be entitled to a bonus, but they should be treated simply as are other undertakers engaged in business for business profits.

We do not wish to convey the impression that the problems of forest development and conservation can be solved through taxation alone.

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[1] Report of the Massachusetts Commission on "The Taxation of Wild or Forest Lands" (1914).

We simply maintain that much can be done in this direction through public and private co-operation in taxation. "A more stable kind of forest ownership, divorced from manufacture to a larger degree than now, must come about before the ills of the lumber business can be permanently cured. . . . The extension of public forest ownership, State and national alike, should have a large part in bringing this about."[2] "Only by the efforts of the Federal Government in getting control of a sufficient area on which to grow forests, as the European nations are doing, and in this way to compete with the private holders of forest lands, can we hope that the concentration and private control of timber land will be broken."[3] It appears, therefore, that taxation is but one of the complex forces to be considered, and that ownership is also of great significance in the proper solution of the problems of forest development and conservation.

FARM WOODLOTS

Farm woodlots present a somewhat different problem from that of forests held primarily for commercial purposes. The timber on farm woodlots is held or should be held for the most part not for exploitation for profit, but rather for the purpose of supplementing the lumber and fuel supply consumed on the farms. At the present time the possession of such a supplementary supply is a matter of no little importance to the farmers. These considerations, coupled with others, lead one to the conclusion that farm woodlots should likewise receive careful attention in matters of taxation, and that there may even be some justification in applying to them a different method from that used in levying upon commercial forests. In the case of farm woodlots, therefore, which are to be retained permanently as a part of the farm, we are of the opinion that they should be taxed as unimproved lands, and that the timber thereon should be exempt. Only recently was there brought to the attention of the writer a case in which the farm owner had decided to clear his woodlot because, "everything considered, taxes and all," the land was worth more to him for other purposes. At the same time both the owner, a city resident, and the tenant on the farm were experiencing great difficulties in securing a sufficient supply of coal for domestic consumption. That the exemption from taxation of the timber growth on farm woodlots will prevent the destruction of the timber we are by no means certain, but we are sure that it will tend in that direction.

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[2] Bulletin No. 114, U. S. Dept. of Agriculture, p. 5.
[3] Scheftel: The Taxation of Land Value, p. 419.

EXEMPTION AND BOUNTIES

Some States have not only exempted forest property from taxation, but have also subsidized the owners of forests in the interest of development and conservation. Experience has proved, however, that neither exemption nor bounties have led to any marked increase in timber culture. Bounties need not demand our serious attention, for they have no place in a discussion on taxation. Concerning bounties, however, the following statement of the Massachusetts Commission is conclusive: "We believe that, except in unusual cases, bounties are wrong in principle. To secure the reforestation of mountain slopes that need to be kept under permanent forest cover, a government may be justified in offering pecuniary inducements; but under ordinary conditions timber production no more needs, nor should receive, a bounty—or exemption from forest taxation—than the production of any crop. Forests can and should be taxed, and other countries have made them a reliable and productive source of revenue." We are of the opinion, however, that certain other conditions and circumstances may justify bounties, especially if it is found that they will actually stimulate tree-planting. Such conditions apparently obtain in some of our Middle Western States, which are almost totally devoid of timber.

As observed above, the exemption of forest lands for a period of years during the early growth of the trees has for the most part been ineffectual in stimulating forestation. The revenue thus lost through the exemption of this class of property is frequently made up by increasing the levy on other classes of property. Even if this is not done, exemption for a brief period of years affords but little inducement to plant trees, so long as the more mature crop is later subjected to the burdens of the general property tax.

RECENT CHANGES IN FOREST TAXATION

With these preliminary observations, we will now turn our attention to the examination of the methods of forest taxation prevailing at the present time. Six States have more or less recently enacted laws providing for more scientific and more equitable methods of taxing timber property. These are Massachusetts, Connecticut, Vermont, New York, Pennsylvania, and Michigan. In these States the general tendency is to substitute for the annual tax on growing timber a tax to be levied and collected at the time the timber is cut. There is therefore a formidable beginning of a tax reform relative to the taxation of forests, which recognizes the difference between levying an annual tax on prop-

erty yielding an annual income and levying a tax on property which yields an income only after a long period of years.

We will first direct our attention to the Massachusetts law, entitled "An Act to Provide for the Classification and Taxation of Wild and Forest Land." This law was approved June 2, 1914. In accordance with its provisions, owners of woodland or land suitable for forest planting may have such lands classified for taxation purposes under the following designation: (1) Land with trees of merchantable value, known as woodlot. (2) Land without trees of merchantable value, known as plantation. These classifications are limited to tracts of three or more acres, except when tracts of smaller area are to be consolidated with other tracts.

Owners desirous of having their lands classified, provided such lands are suitable for classification either as woodlot or plantation, are required to make application to the clerk of the city or town in which the land is located. The application must be accompanied by a description of the lands and shall state whether or not the land is encumbered, and, if so, the written consent of those holding claims against the property must be presented. The application having been made, the clerk of the city or town must notify the assessors at once, who, in turn, shall forthwith determine, after examination, whether the lands are suitable for classification. If, in the assessor's judgment, the lands are suitable for classification, they shall make separate valuation of the land and of the trees growing thereon, which value shall be the fair cash value of the trees on the stump. If, however, after careful examination of the lands, the assessors are of the opinion that the lands are not suitable for classification, the owners shall be notified and they may then appeal from such decision to the State forester. The valuations, having been made, are submitted to the owner for his acceptance. If he accepts the valuations, notification is given to the clerk of the city or town, who records the same and issues a certificate of classification.

Lands classified under the provisions of the act are subject to the forest land tax, and lands classified as woodlot are subject to the forest commutation tax, levied in the following manner:

(*a*) The assessors are required to open an account of all lands classified as woodlot on or before the first day of April, 1919, which account must show the sum of the taxes assessed upon such lands, exclusive of buildings thereon in the year 1913.

(*b*) From this sum there shall be deducted for each year of the five-year period the total forest land tax assessed for that year, and the remainder shall constitute the amount of the forest commutation tax for that year.

(*c*) The amount of the forest commutation tax for each year of the five-year period is apportioned to the various woodlots in proprtion to the stumpage value of the trees growing thereon at the time of classification, and the several amounts constitute the forest commutation tax for which the respective tracts are liable for that year.

(*d*) Except for certain reductions as a result of destruction by fire or otherwise, each tract of woodlot classified on or before April 1, 1919, shall thereafter be liable for the same amount of forest commutation tax as was levied in the year 1919.

(*e*) Upon tracts classified as woodlot after April 1, 1919, the annual forest commutation tax shall be the amount of tax assessed and levied upon such tract, exclusive of the buildings thereon, in the last levy prior to the date of classification, less the amount of forest land tax assessed and levied in the next assessment subsequent to the date of classification.

Forest Product Tax

Lands classified as above noted are subject to a forest product tax which is levied and collected as follows:

(*a*) Owners of classified lands are required to report annually to the assessors the gross amount and stumpage value of all wood cut from the land during the year, as well as the gross amount of all other products of the land and such other income derived from the land as does not constitute an element in determining the value of the land for the purpose of assessing the forest land tax.

(*b*) In case of the cutting and subsequent removal of timber or wood in excess of an amount valued at $25, owners are required, at least ten days before the removal, to notify the assessors of the intended removal and to give the amount and stumpage value of the same. The assessors may then examine the wood and estimate its value. In case of disagreement concerning the value, the matter may be adjusted by the State forester, or upon request shall be arbitrated by three disinterested persons—one chosen by the owner, one by the assessors, and the third by the two thus chosen. Notification of assessors is not required for the removal of timber to the amount of $25 by owners other than corporations, provided the wood is for personal use or for the use of the tenant of the land on which the timber is located.

(*c*) Forest product taxes are levied and assessed annually upon the gross value of all wood, other products and other income as above ascertained, at rates varying from one per cent for the period prior to 1919 to five per cent for the five-year period, 1934-1939. For each

five-year period intervening between the years 1919 and 1934 the rate increases one per cent over that of the preceding five years. On and after the year 1939 the annual rate shall be six per cent.

Collection of the tax is assured by a provision of the law whereby the tax is made a lien upon the land in respect of the product or income from which it was assessed. Furthermore, the assessors are empowered to require of the owner either a cash deposit of the amount of forest product tax as estimated by the assessors or, at his option, a bond, with good sureties, conditioned upon the payment of the tax when levied. Forest product tax shall also constitute a lien upon the wood or other product for so long as they are in the possession of the owner of the land from which it was produced, or of a person taking the same with knowledge that the assessors have acquired security for the tax.

We should make mention of the fact that provision is made whereby the owner may, under certain conditions, withdraw his lands from the classified list.

No less important than the foregoing provisions relative to the taxation of the classified lands are the provisions relating to the administration and supervision of the lands so classified. The general regulations for seeding or planting the classified lands to forest trees are under the direction and supervision of the State forester. Owners of the lands classified, in accordance with the provisions of the law, are required, within three years after classification, to seed or plant all parts suitable for seeding or planting and have not been naturally restocked. However, with the written approval of the State forester, the time may be extended. On clearing any tract of classified land equal to or in excess of three acres, the owner must either leave a suitable number of trees to provide for reseeding or must reseed or plant the cleared tract in accordance with the regulations mentioned above.

Connecticut.—In Connecticut woodland and land suitable for forest planting not less than five acres in area and not exceeding in value $25 per acre, exclusive of timber growing thereon, may, upon application, be given special classification as forest land for purposes of taxation. Owners of such lands, desirous of having them classified, must file with the State forester an application, accompanied by a sufficiently accurate description, and by the sworn statement of the town assessors, giving the true value of the land alone and the true value of the timber thereon. The State forester thereupon examines the lands, and, if satisfied as to their suitability for forest planting or as to their right to be classified as woodland, issues a classification certificate. The law

was so amended in 1917 as to permit the owner to appeal to the superior court for the county in which the land is situated from the valuation of the assessors, both with respect to land and timber. Similar privilege was extended to owners to appeal from the decision of the State forester for refusing classification.

Lands bearing timber of more than ten years growth, the timber having a taxable value, may be classified as forest land, and, after such classification, shall be taxed at the local rate, but in no case to exceed ten mills upon the true actual value of the land and timber separately as established by the assessors at the time of classification. After the lapse of a period of fifty years there must be a revaluation of both the land and timber, and for the succeeding fifty years the local rate of taxation shall be applied to the newly determined valuation, but in no case shall the rate exceed ten mills. At the end of the second fifty-year period, provided classification has been maintained, new valuations shall be made as often as necessary, and the local rate of assessment, disregardless of amount, applied thereto.

In addition to the levy cited above, there is the yield tax. When a cutting is made, the material removed is subject to a graduated yield tax at the following rates on the value: 1 to 10 years, 2 per cent; 11 to 20 years, 3 per cent; 21 to 30 years, 4 per cent; 31 to 40 years, 5 per cent; 41 to 50 years, 6 per cent; 50 years, 7 per cent.

Lands fully stocked with forest trees not over ten years old, except the scattered older trees; lands incompletely or partially stocked with forest trees not more than ten years old, when planted with a sufficient number of approved additional trees to insure a spacing of approximately 6 feet by 6 feet over the entire area, and open lands planted with not less than 1,200 forest trees to the acre, provided the trees are of approved kinds, may be classified as forest lands in the same manner as above noted, and taxed at the local rate on the land valuations as established by the town assessors. In no case, however, shall the rate exceed ten mills. When a cutting is made on such lands, the material removed is subject to a flat rate yield tax of 10 per cent of the value.

When a timber crop is removed and the lands are reforested, either naturally or through planting, the reforested lands may be reclassified or the existing classification continued and taxed on the established value for the remainder of the uncompleted period. If the existing valuation is continued, a revaluation shall be made at the end of the uncomplete period.

Classification once established shall be continued as long as proper forest conditions are maintained. Upon request of the local assessors

or upon his own initiative, as often as he deems advisable, the State forester shall examine lands under classification to see if the provisions of the law are being complied with, and, if not, he shall cancel the classification and thereafter the lands shall be taxed as other land. In order to prevent the owners of such lands whose classification is canceled from escaping their just share of the tax burden, the assessors when the classification is canceled are directed to deduct the valuation of both land and the timber thereon, as established at the time of classification, from the then value of land and timber as assessed for future taxation, and on the excess value thus determined there shall be collected an annual tax of five mills for each year of the period the land was under classification. This tax is to be in addition to any annual tax or yield tax which may have been paid.

When a cutting is made, the owner, before any timber is removed, is required to file a sworn statement with the local assessors and with the State forester of the quantity or stumpage value of all timber cut. If, in the opinion of the assessors, the cutting is insufficiently valued, they may determine the value. The owner, however, if not satisfied with the valuation as determined by the assessors, may have the matter referred to a special board, consisting of the first selectman, the town clerk, and the State forester, whose decision is final. Material cut for domestic use, limited to fuel, fencing, building, or other improvements which tend to develop the property of the owner and to increase the taxable value of the same, is exempt from the yield tax, provided such material is used by the owner or by the tenant of the owner living in the same town in which the land from which the material is removed is located.

Vermont.—Vermont's law, with respect to forest taxation, which is very similar to that of Connecticut, dates from the year 1913. Here, as in Connecticut, owners desiring to have lands classified as forest lands are required to make application to the State forester. Cut-over land fully stocked with forest trees not over fifteen years old; except scattered trees which do not increase the assessed value of the property; cut-over or other land incompletely or partially stocked with forest trees not over fifteen years old, when planted so as to insure a spacing of approximately 6 feet by 6 feet; and open land planted with not less than 1,000 trees of approved variety to the acre, provided such lands are outside the limits of a city or village, shall be classified as forest land and shall thereafter be taxed annually at the local rate on a valuation of the land alone. This valuation is established by the listers at the time of classification, but in no case shall exceed $3 per acre. This

valuation shall prevail till the year 1950, at which time there shall be a revaluation, but without any maximum prescribed limit, and this newly determined valuation shall prevail for fifty years and be subjected to the prevailing local rate of taxation.

Classification, once having been made, shall continue as long as proper forest conditions are maintained to the satisfaction of the State forester. In case a classification is canceled, the owner of the land is required to pay on the stumpage value of the standing timber one-half of one per cent per year for the entire number of years under classification. These levies are in addition to any annual or yield tax which may have been paid or may be collectible.

Owners desiring to cut, except for domestic purposes, are required to file with the local listers and the State forester a sworn statement of the value of the timber to be cut. If either deems the valuation too low, the State forester shall decide, subject to appeal to a board of three, consisting of the first selectman, the town clerk, and the State forester. Upon the gross valuation thus finally determined there is levied and collected a tax of 10 per cent.

In addition to the foregoing provisions regarding classification, owners of waste, partially denuded or wild forest lands of five acres or more, outside of villages or cities, occupied wholly or in part by a natural or planted growth of trees of more than fifteen years, or by both, which lands are not suitable for cultivation, may apply to the listers of the town to have such tracts separately classified for taxation purposes. Upon receipt of the application for classification, the listers shall examine the lands, and, if satisfied that they are suitable for forests, shall designate them as forest lands and set them in the grand list at the valuation fixed at the last quadrennial appraisal. To this valuation the annual local rate shall be applied until 1950, at which time a new valuation shall be made of both land and timber, and this new valuation shall be subject to the annual local rate of taxation for a period of fifty years.

Owners desiring to cut timber from such classified lands other than for domestic use must give the listers at least thirty days' notice. After the cutting is done, the owner must make an accurate measurement or count and file the same with the county clerk. Then the listers shall appraise the stumpage value, and before the removal of any of the timber the owner shall pay to the town treasurer one-tenth per cent of such value for each year that the land has been classified, but in no case shall the tax exceed 7 per cent of the valuation. When, in the opinion of the listers, the trees growing on such land are mature or

when such land ceases to be used as a wood or timber lot to an extent entitling the owner to the privileges of the act, that fact shall be reported to the owners or managers, and if they decline to cut the timber they shall pay within three months the amount of tax due as above specified. Thereafter the land shall be appraised and taxed as other lands not used as wood or timber lots.

New York.—The method of aiding and stimulating forestry in New York through taxation differs somewhat from the methods prevailing in the States above referred to. In this State whenever the owner of lands to the extent of one or more acres, and not exceeding one hundred acres, shall plant the same with forest trees to the number not less than eight hundred to the acre, and whenever the owner of existing forest or brush lands to the extent of one or more acres, and not exceeding one hundred acres, shall underplant the same with forest trees to the number of not less than three hundred to the acre, and when proof of such planting is filed with the proper authorities, such lands so forested shall be exempt from assessment and taxation for any purpose for a period of thirty-five years from the date of the levying of taxes thereon immediately following such planting; and such existing forest or brush land so underplanted shall be assessed at the rate of 50 per cent of the assessable valuation of such land, exclusive of any forest growth thereon, for a period of thirty-five years from the date of the levying of taxes thereon immediately following the underplanting.

Owners of lands desirous of securing the benefits of the foregoing provisions must file with the conservation commission an affidavit making proof of such planting or underplanting and setting forth an accurate description of the lands. The commission after the affidavit is filed must cause an inspection to be made by a competent forester or other employee of the commission, who must make and file a written report of such inspection. If the commission is satisfied that the lands have been planted or underplanted, so as to comply with the provisions of the law, it shall execute a certificate to that effect and file the same with the treasurer of the county in which the lands are located.

Lands situated within twenty miles of the corporate limits of a city of the first class, or within ten miles of the corporate limits of a city of the second class, or within five miles of the corporate limits of a city of the third class, or within one mile of the corporate limits of an incorporate village, shall not be entitled to the benefits of this law.

If any land, exempted under the provisions of the law, continues to be used exclusively for forest purposes after the expiration of the thirty-five-year period, the land shall be assessed at its true value and

the timber growth thereon shall be exempt from taxation, except if such timber shall be cut before five years after the exemption period has expired, such timber growth shall be subject to a tax of 5 per cent of the estimated stumpage value at the time of cutting. Owners proposing to make any cutting other than for thinning purposes are required to give thirty days' notice to the assessors, who must forthwith assess the stumpage value of such proposed cutting, and such owner shall pay before cutting the timber 5 per cent of such assessed valuation.

In addition to the foregoing provisions for the exemption and reduction in assessment of lands planted with trees for forestry purposes, New York has another law providing for the exemption and reduction in assessment of lands maintained as wood lots and to encourage the growth of trees for such purposes. Both laws date from the same year, 1912.

In accordance with the provisions of the latter law, the owner of any tract of land in the State, not exceeding fifty acres, which is occupied by a natural or planted growth of trees, or by both, which shall not be situated within twenty, ten, or five miles of the corporate limits of cities of the first, second, or third class respectively, nor within one mile of the corporate limits of an incorporated village, may apply to the conservation commission to have such lands separately classified for taxation purposes. If, after the lands are duly inspected, the commission is satisfied that they are suitable to be classified, it shall submit to the owner a plan for future management of the land and trees and shall also issue a certificate of classification.

So long as the land so classified is maintained as a wood lot and the owner complies with the provisions of the law, it shall be valued for taxation at not to exceed $10 per acre. In determining the value of the land for purposes of taxation, the assessor shall not take into account the value of the trees growing thereon, nor shall such lands be assessed at a value greater than other similar lands within the same district which contains no forest or tree growth are assessed. Similar provisions are made with reference to cutting timber from such lands as are made in the case of lands *planted* with trees referred to above. Mention should be made of the fact that all wild or forest land within the forest reserve are assessed and taxed at a like valuation and rate as similar lands of individuals within the counties where situated.

Pennsylvania.—Special legislation in Pennsylvania relative to the taxation of forests was enacted in the year 1913. The law, approved June 5, 1913, prescribes that "in order to encourage the growing of such trees as will at the proper age be suitable for merchantable forest

products, all surface land set apart and used exclusively for growing such trees shall constitute a separate and distinct class of land, to be known as auxiliary forest reserves."

Owners of surface lands desirous of having their lands so classified must notify the State Forestry Reservation Commission, which shall in turn cause such lands to be examined by "some person learned in the practice and principles of forestry" and a report made thereon. If the commission is satisfied that the lands are suitable for classification as auxiliary forest reserves, it shall notify the county commissioners to that effect. Thereupon the county commissioners shall place the land in the established class and shall retain it therein until the trees become sufficiently mature for merchantable forest products or the land be devoted to other purposes. Written agreement, however, is required of the owner that he will care for the trees according to the instructions and directions of the commission, under penalty of having his lands removed from the special classification, in which case there shall be collected the difference in the amount of tax which would have been paid by the owner had not the land been classified and the rate provided for auxiliary forest reserves. Lands set aside and classified as auxiliary forest reserves shall be valued for taxation purposes not in excess of $1 per acre, and shall continue to be so valued as long as the lands are so classified. Exception is made, however, in case of lands underlaid with minerals.

When owners are about to cut timber from auxiliary forest reserves, they shall give a bond to the county treasurer equal to 20 per cent of the amount of the estimated value of the timber to be harvested, and to be approved by the county court, conditioned to pay to the county treasurer within ninety days after harvesting 10 per cent of the value of the trees at the time of harvesting. The value of the trees shall be ascertained by statement under oath or affirmation. If, however, the county commissioners are not satisfied as to the accuracy of the valuation returned by the owner, the court of common pleas, on petition of the commissioners, shall appoint three appraisers who, after having been duly sworn, shall examine the trees and report on the value thereof. Either party, if dissatisfied with the report of the board of appraisers, has the right within ten days to appeal to the common pleas court.

As observed above, the State pays on its Forest Reserves two cents per acre for school and two cents per acre for county or road purposes.

Michigan.—Michigan is operating under the so-called general property tax, and all property is required to be assessed at its true cash

value and all pay the same rate of taxation. Timber lands, therefore, receive no special consideration except in the case of private forest reservations not to exceed forty acres. The present law relative to the taxation of private forest reservations was enacted in 1917.

In accordance with the provisions of this law, on any tract not exceeding 160 acres, of which at least one-half is improved and devoted to agricultural purposes, there may be selected by the owners as a private reservation a portion not exceeding one-fourth of the total area. If the owner shall plant not less than 1,200 trees on each acre of the private reservation, or if the land is partially stocked with forest trees and the owner supplements this growth by planting forest trees to assure a spacing of approximately 6 by 6 feet, then such lands shall be entitled to the benefits of the act. Further provision is made prohibiting the owners from pasturing stock upon such reservations until at least 90 per cent of the trees are two inches or more in diameter. Care of trees is under the direction and supervision of the State Board of Agriculture.

If the private reservation is properly planted and continuously maintained and cared for according to the plans of the State Board of Agriculture and according to the provisions of the law, the value of the land in excess of $1 per acre shall be exempt from all taxation. When an owner desires to cut trees from his reservation other than for domestic consumption, he shall notify the assessor, and before the removal of the cut timber he shall make a measurement or count of the trees cut and file a report of the same with the assessor, who shall forthwith assess the stumpage value and issue a license for the removal, conditioned on the payment of a fee of 5 per cent of the appraised value.

Owners withdrawing their lands from such classification or failing to comply with the provisions of the law shall pay a fee of 5 per cent of the stumpage value of the timber as appraised by the tax assessor.

SUMMARY OF THE LAWS CONCERNING TAXATION OF WOODED LANDS IN OTHER STATES

Alabama.—Owners of lands which have been cleared of trees or the assessed value of which is not over $5 per acre may, upon making a contract with the forestry commission to plant and maintain timber trees on such land for ten years under the direction of the commission, have such lands exempted from taxation for a period of ten years.

Idaho.—Chapter 112 of the Public Acts of 1917 prescribes that "in order to encourage the growing of nut-bearing, hardwood, and other merchantable forest trees, at present almost entirely neglected in the

agricultural sections of this State, and by so doing to increase the material resources of this State, it is deemed both necessary and just that the tracts whereon they are grown be exempted from taxation during a limited period, when the trees are too small to have any commercial value and the land itself cannot be used for any other purpose."

Pursuant to the provisions of the law, claimants of the benefits of its privileges may have a forest tract not to exceed twenty acres, provided such land is not valuable for agricultural purposes, does not contain any growth of native timber, and is planted and cared for in accordance with regulations prescribed under the supervision of the Forestry Department of the University of Idaho. Exemption continues for ten years from planting, during which time no timber shall be cut. But any improvements upon a forestry tract other than the growing trees thereon shall be subject to taxation.

Indiana.—A law in this State provides that the property of forestry associations organized under the statutes of the State shall not be taxable for State, county, township, town, or any other purpose. (R. S., 1914, pp. 622, 623.)

Iowa.—The Iowa law provides for forest reservations in private ownership of not less than two acres, on which there must be not less than 200 growing trees per acre. Before being accepted as a forest reservation, the trees shall have been planted for a period of at least two years. In addition to this, provision is made for fruit-tree reservations of not less than one nor more than five acres. Upon such reservations there must be trees to the number of 70 at least. The foregoing reservations are assessed for taxation at $1 per acre for a period of eight years from the time of planting. Furthermore, the assessed value of lands so planted shall not be increased on account of the value of the trees. (Code, 1913, p. 493.)

Kansas.—In this State county commissioners are empowered to offer bounties not to exceed $10 for each acre for a period of five years to any one planting one or more acres with forest trees and cultivating the same for five years, provided that the trees shall not be at a greater distance than 10 feet apart. (G. S., 1915, ch. 119.)

Louisiana.—The statutes of Louisiana prescribe that when the owner of any land which has been denuded of trees or any other land the assessed value of which shall not exceed $5 per acre shall contract with the Commission of Forestry to supervise planting and growing upon the land suitable and useful timber trees, and shall maintain the same for a period of not less than thirty nor more than forty years, the assessors shall fix a valuation for taxation purposes of $1 for timber and land for the period. (R. S., 1915, p. 1107.)

Maine.—Cleared lands or lands from which the primitive forests have been removed, which the owner plants with forest trees to the number of not less than 640 to the acre and maintains them properly for a period of three years, may be exempted from taxation for a period of twenty years. (R. S., 1916, p. 229.)

Minnesota.—Any person planting one or more acres with forest trees other than black locust, not over 12 feet apart, and properly cares for them and keeps them growing, shall receive for a period of six years $2.50 per acre, but in no case shall there be paid to such person more than $25 in any year. This law, however, does not extend to railroad companies nor to any persons planting trees in compliance with previous acts.

While the foregoing law bears directly on the encouragement of forest development, it is only fair to Minnesota to make mention of the forward step in taxation made by her in 1913, when a law was enacted establishing a general scheme of classification of property for assessment purposes. Pursuant to the provisions of that law, property is divided into four classes, as follows: (1) Iron ore is valued and assessed at 50 per cent of its value. (2) Household goods, wearing apparel, etc., at 25 per cent of their full value. (3) Live stock, merchandise, poultry, farm products, manufactured articles, machinery, and rural real estate at 33⅓ per cent of their full and true value. (4) Urban real estate at 40 per cent of its value.

Though this law is a step in the right direction, it fails, in the opinion of the writer, in not making a distinction between forest and agricultural land and in not requiring a separation between the value of the land and that of the timber thereon. No justification can be found either for the discrimination against certain kinds of real estate, for example, urban and iron ore lands. (G. S., 1913, p. 1133; Laws, 1913, ch. 483.)

Nebraska.—In this State there is a statute which prescribes that "the increased value of lands by reason of live fences and forest trees grown and cultivated thereon shall not be taken into account in the assessment thereof." Article IX, section 2, of the State Constitution expressly permits such legislation.

New Hampshire.—Pursuant to the provisions of a law enacted in 1903, owners of any lands which shall be planted with timber or forest trees, not less than 1,200 to the acre, shall be entitled to a rebate of the taxes assessed upon the land, as follows: For the first ten years after planting, a rebate of 90 per cent; for the second ten years, 80 per cent, and for the third and final period of rebate, 50 per cent. The fore-

going rebates are conditioned on the proper maintenance of the trees. After the trees have been planted for a period of ten years, the owners may then cut the same, so that not less than 600 trees shall be left to the acre, but no portion shall be absolutely cleared during the rebate period.

In response to an inquiry, the Acting State Forester informs me that this law is seldom, if ever, taken advantage of, for the reason that lands covered with young trees are so lightly taxed under the regular system that there is very little incentive for the owners to invoke the law.

North Dakota.—This State has a statute which provides for a bounty of $3 per acre for tracts of prairie land planted to any kind of forest trees, provided that such trees are properly maintained; that there are not less than 400 trees to the acre, and that the groves are on tracts of not less than eighty acres. In no case, however, shall the bounty exceed the amount of the tax levied on one-fourth section of land. This bounty may commence one year after planting and is deducted annually from the farm taxes for five years. A bounty is also paid for forest trees planted in hedge-rows as boundary lines. The bounty, paid annually for five years, amounts to $2 for eighty rods of hedge-row. (Ch. 262, Laws, 1915.)

Rhode Island.—One or more acres of land worth not more than $25 per acre, when planted with certain specified kinds of trees and managed under a forest working plan, approved by the State Commissioner of Forestry, shall be exempted, upon application of the owner, from all taxation for a period of fifteen years, provided that not more than 300 acres owned by a single person, corporation, or association shall be exempted. (G. L., 1909, p. 243.)

South Dakota.—The county commissioners of the several counties of the State are authorized to pay a bounty of $5 per acre for each of ten years to those cultivating, after 1915, forest trees to the number of not less than 800 to the acre. The bounty shall not be paid on an acreage greater than twelve. (Ch. 147, Laws, 1916-17.)

Utah.—County commissioners may pay not over 25 cents for each tree over four years old which has been planted along roads and highways for shade or ornamental purposes. (C. S., 1907, p. 298.)

Wisconsin.—Lands not within two miles of any incorporated city or village, except upon written approval of the State Forester and not worth more than $10 per acre, if planted with forest trees to the number of not less than 1,200 to the acre and properly maintained, may be exempted from taxation for a period of thirty years. After ten years the owner may thin out the trees to 600 per acre. The benefits of this

exemption shall not apply to more than forty acres per owner. A further provision of the law prescribes that when tree belts of certain specified character are planted the land on which they are planted shall be exempt from taxation until the trees are 12 feet in height, after which the owner is granted an annual bounty of $2 per acre. (G. S., 1915, p. 1106.)

Wyoming.—The county commissioners are empowered to pay any sum not to exceed $10 for a period of five years for each acre planted to trees, provided that the trees are not over 10 feet apart and that they have been kept alive and thrifty for at least five years before any bounty shall be paid. (C. S., 1910, p. 389.)

HOW CAN THE PRIVATE FOREST LANDS BE BROUGHT UNDER FOREST MANAGEMENT?

By W. N. Sparhawk

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The country's requirements for timber will necessitate the continuation of forest production upon practically the whole of our present forest area, exclusive of land suitable for agriculture. At least seven-tenths of this area is now in private ownership. These facts lead inevitably to the conclusion that forestry must be practiced on private lands, unless we are to depend on other countries for our timber supply in the future.

Two ways in which this may be brought about have been suggested: First of these is the general acquisition of forest lands by the public, until there shall ultimately be enough such land in public ownership to insure a timber supply sufficient to meet the national requirements continuously.

Among the arguments in favor of such a plan are:

1. The growing of forest crops is a long-time venture whose returns are uncertain. Private enterprise, which depends for its return solely on profits, cannot be expected to go into such a business under the economic conditions which have prevailed hitherto. The public, on the other hand, can afford to undertake forestry even if its profits cannot be shown in dollars and cents, because of the great indirect public benefits derived from forests and from an assured supply of timber.

2. If the public owns the forests they can be managed for the public good, even though such management might not in certain localities be in accord with the methods which produce the largest money return. In the care of protection forests, for instance, the direct money return should be a subordinate consideration, yet private owners could hardly be expected to manage them in such a way as to protect watershed values to the serious reduction of their own profits or perhaps the entailment of a direct loss.

Serious disadvantages of this method are the great initial cost of acquiring the land, because of which it is likely that the acquisition would proceed slowly, and that productive capacity of our remaining forests would be greatly reduced before they could come under public

control, and the fact that sentiment in a great many quarters is against Government ownership.

The second method which has been suggested is for the public to compel private forest owners to practice forestry. Such a plan would retain the advantages of private ownership and would not cost the public as much at the start. There are, however, many arguments against it:

1. A large element of public sentiment would probably be against such a proposition, so that it would be very difficult to put it into effect.

2. Even if the practice of forestry were made compulsory, there would tend to be constant friction between the owners on the one hand and the regulatory authority on the other concerning such matters as time and method of cutting, reforestation, etc.

3. Unless some scheme were devised whereby the public should assume the risks and bear part of the costs, the owner would have to carry all of the liabilities, together with added costs involved in safeguarding forest values other than the timber, and the public would get the benefit.

The risks and extra costs, which are really the only reasons why private owners have not long ago voluntarily adopted the practice of forestry, are not imaginary, although they are very frequently overestimated. A private investment, particularly a long-term investment, such as that involved in the practice of forestry, in order to be attractive must combine at least these three elements: Safety of principal, certainty of a regular and reasonable rate of interest, and negotiability.

Under the present conditions the average forest investment has only the antitheses of these qualities. The principal may be lost or seriously depreciated by fire, by storm (such as the hurricanes and tornadoes of the Gulf States), by disease (such as the white-pine blister rust and chestnut-bark disease), by insects (such as the gypsy and browntail moths or larch sawfly), by weather (frost, drought in young plantations), or by other causes. Except with comparatively large holdings, returns cannot be expected every year, but will be periodic, and in the case of young forests no returns at all will be received for many years. The rate of return is also most uncertain, since it is affected not only by the risks mentioned above, but also by the correctness of the methods of management which may be adopted, by the costs of management in the future, by changes in the rate of taxation, and finally by the price which may be received for lumber, and hence for stumpage, at some future date. Moreover, our knowledge of rates of growth and yield of different kinds of timber on different sites and of

the best methods for managing different kinds of forests is not yet sufficiently complete to enable us to definitely and certainly predict the returns which will be received on specific areas, even if all the other risks are eliminated. The negotiable value of a forest property is seldom equal to its true value, so that if for any reason an owner should be obliged to liquidate his investment he would probably lose not only the accrued interest, but also part of the capital value. Only in the case of mature or nearly mature forest would he be likely to get back his investment with the interest it had earned. Moreover, to raise money on such a property would probably require the cutting of the timber, regardless of silvicultural or economic conditions at the time.

Several measures have been suggested to make investments in forestry more attractive to private owners. These include the following:

(*a*) The adoption of more just and scientific systems of taxation of forest properties. This should be done, provided care is taken that the system adopted is really just as compared with the taxation of other property and is not in fact a subsidy or discrimination in favor of forest owners. Tax reform, however, goes only one step toward the desired end.

(*b*) Organized forest-fire protection by the public, the owners usually paying part of the cost. This certainly reduces the fire hazard, but no system of protection yet devised has entirely eliminated the risk. Besides, when a loss occurs, the loser cannot, as in many other kinds of investment, recover insurance. He is somewhat in the position of a man who has paid premiums on his insurance policy for many years, but cannot collect the insurance when the loss comes. A system of State (or State-encouraged, but privately operated) forest insurance might go far toward remedying this condition. Such insurance, however, if it is to make capital invested in forestry safe, should cover not only losses by fire, but also by weather, insects, disease, and all other causes.

(*c*) Subsidies to private owners to encourage them to practice forestry. This is clearly uneconomic and may be justified only on the theory that in this way the public pays for the public benefits which will be derived from the forests so subsidized. It hardly seems likely that such a measure will ever be adopted on a large scale, or that it would be effective, since it does not remove any of the uncertainties involved in the business.

(*d*) Long-term loans at low rates by the public to forest owners to enable them to carry their forest investments. Such loans might make

it practicable for owners to be content with a lower rate of return from forestry, but they would not guarantee that the owner would receive any return at all, or that he might not lose his entire capital from any of the various causes enumerated above.

(*e*) Guaranteed future prices for stumpage or lumber. Such a measure would remove one element of uncertainty only and does not appear either practicable or desirable.

(*f*) Associations of forest owners to co-operate in the management of their forests and in the disposal of products. In the case of small owners, the object of such combination would be primarily to form forest units of sufficient size for economical and efficient management, and even to make possible an annual instead of a periodic return to individual owners. In the case of large owners, the purpose of combination would be rather to control the supply of timber, regulate cutting, and maintain prices. Each of these plans would make forestry more attractive to individual owners of the respective classes concerned, yet neither one covers the entire ground. Moreover, there is a considerable element of danger in such a combination of large owners. This danger, common to all schemes which would give a controlling part of any natural resource to private monopoly, threatens the interests of small owners as well as of the public, in that the public interests in the forests may be subordinated to private profits and that consumers may be injured through restriction of output and maintenance of artificially high prices.

A third plan may be suggested, by which the practice of forestry on lands now in private ownership may be made entirely practicable and which will avoid to a large extent the objections to the other two plans. In brief, this scheme is the retention of private ownership with public operation, for which there is a precedent, although not exactly parallel, in the present operation of our railroads. The public would not buy the private forest lands under such a plan, but would lease them at a fixed annual rental and would use them as it saw fit for the growing of timber. Private owners would thereby be guaranteed a regular and sure return on the investment and would be relieved of any risk whatsoever, all of which would be assumed by the public. The public would take any profit or loss resulting from the practice of forestry, would carry all of the risks incidental to the business, and would receive the benefits which accrue from the presence of forests and from the certainty of domestic timber supplies in the future.

While the details of such a leasing system have not been worked out, a few points may be suggested:

1. Only true forest land should be leased—that is, land which is better suited to growing timber than for any other use or which for reasons of public policy should be forested (protection forests).

2. Since the principal is absolutely safe and the return regular, sure, and devoid of risk, the private owner should be content with a rate of return comparable with the rate received from Government bonds, possibly between 3 and 4 per cent of the value of the land. If he does not practice forestry on such land, he does not under present conditions receive any return whatever on his investment except in the way of unearned increment through rise in land values. If it should seem best to allow him this unearned increment under the leasing system, it could be provided for by periodic reappraisal of the land value.

3. The rental should be paid only on the value of the bare land in case of "skinned" land, or on the value of land plus growing stock in the case of land already stocked with growing forest. In the case of mature forests, the actual stand would in most cases be greater than the normal growing stock. Rental should not be paid on this surplus stock, which should either be bought by the public at its present appraised value or removed under restrictions within a definite period by the owner. The former course would probably be preferable, since it would allow the publicly operated forests to be put on a sustained yield basis from the start.

4. Leases should run for at least a rotation, but should probably provide that the owner might recover his land at his option by the payment of all costs incurred by the public if the forest on it should be so young that the timber would not repay the public for its investment. If the owner should pay all costs, he should of course get his land plus whatever forest might be growing on it.

5. The public should pay taxes on the forest and probably also on the land itself. This might be done by direct assessment or by some such arrangement as now obtains in the case of the National Forests. If the public should take over payment of taxes on the land, the owner's investment would be comparable to a tax-free Government bond, so that he should be contented with a minimum rate of return.

6. Leasing should probably be voluntary on the part of the owners, except in flagrant cases of forest destruction, where the owner refuses or neglects to restore the land to productive condition.

7. Exploitation of the forests could be carried on by private enterprise under restrictions, as is now done with the National Forests, or it could be done by the public, especially in places where private concerns might for any reason hesitate to go in.

Some of the advantages of this leasing system would be:

(*a*) The initial cost would be much less than in the case of purchase of the forests by the public, while the subsequent costs would be the same; for the annual interest on the purchase price would have to be included in computing costs.

(*b*) There could be no objection, on the part of those opposed to Government ownership, to public operation of necessary natural resources which private owners persistently fail to operate. Since the public would be concerned rather with growing timber than with manufacturing it into lumber, the lumber industry would not be interfered with except to the extent of being assured of continuous supplies of timber, which it is certain not to have under present conditions.

(*c*) Private owners of forest lands would get a sure and regular return from their investments, while under present conditions most of them get no return whatever. Their investments would have a negotiable value, based on the rentals from them, and transfers of ownership without affecting the use of the lands would be entirely practicable.

(*d*) The public would secure all the benefits of public ownership of the resources, including control of management, cutting, prices if necessary, and could safeguard other public interests, such as protection of watersheds and public rcreation areas.

(*e*) Complications which would necessarily attend public co-operation with private owners or public control of private forestry business, due to conflicts between public and private interests, would be avoided.

It is not the intention of the writer to argue that either public acquisition of forest lands or their compulsory management by present owners in order to protect public interests have no place in our forest policy. Indeed, it is believed that both courses should be followed as far as may be practicable. It possibly may be desirable that the greater part of our forest area should ultimately be owned by the public, but it does not seem likely that the public can acquire the whole area needed in time to insure the safety of our forest resources for the next few generations. Until the public can acquire the lands, measures should undoubtedly be taken to prevent their devastation. It will not, however, be either practicable or just to the owners to compel them to practice intensive forestry, with all its attendant risks, in order to insure the future welfare of the public, unless the public is willing to go a long way toward guaranteeing that they shall not be the losers. It is believed that some system similar to the leasing system proposed affords a practicable means by which the public—meaning either State or Federal Government—can give such guarantees to the private owners and

at the same time assure management of the forests in the public interest, with a minimum of friction.

NOTE.—It is of interest to note that the Forestry subcommittee of the British Ministry of Reconstruction has recommended that the Government lease private lands for purposes of forest production, under a system somewhat similar to that outlined above.

PUBLIC CONTROL OF PRIVATE FORESTS IN NORWAY

By Samuel T. Dana

U. S. Forest Service

The papers by Colonel Graves and Mr. Olmsted in recent issues of the Journal have focused attention on public control of private forests in the United States. It is evident that from now on the problem as to how to secure and make such control effective is to be a very vital one, not only for the forestry profession, but for the public in general. In attempting its solution, it will be helpful to bear in mind the policies adopted by other countries. Among these, Norway is of special interest in view of the fact that forest and economic conditions there are not so dissimilar from those in many parts of the United States.

Norway is commonly regarded as a well-forested country, capable of exporting indefinitely large quantities of forest products. Many will, therefore, be surprised to learn that more than a quarter of a century ago the destruction and mismanagement of the forests had proceeded to a point where the general public felt constrained to take a part in prescribing how the 67 per cent of forests under private ownership should be handled. On July 20, 1893, a law was passed permitting local communities to adopt regulations for the preservation of protection forests and against the destruction of forests in general. This law was repealed by the law of August 8, 1908, which modified and extended the previous legislation. Failure on the part of many of the local communities to take advantage of the powers granted them by this law led in turn to its being amended and made more drastic by the law of June 7, 1916, which made obligatory the exercise of public control over all coniferous forests for which regulations had not already been adopted by the local communities.

The principal points in the laws of August 8, 1908, and of June 7, 1916, which constitute the legislation under which public control of private forests is now exercised in Norway, may be summarized as follows:[1]

[1] Full translations of these laws have been made by the author and may be secured on application to the Forester, Washington, D. C., by any one desiring to examine them in detail. They are not given in full here, since they are rather lengthy and many of their provisions are of no particular interest to foresters in this country.

1. Local communities are authorized to adopt regulations for the handling of protection forests and other forests under private ownership. Protection forests are defined as forests which serve as protection against landslides, floods, or drifting sand, or as special protection to another forest or to built-up land, and also as forests which, because of their situation at high altitudes, by the sea, or in the far north have such unfavorable growth conditions as to be in danger of complete destruction if too heavily cut or otherwise mishandled. Completely cleared areas can also be regarded as protection forests when it appears probable that such areas may in course of time become reforested and again serve as protection forests.

2. The boundaries of protection forests are fixed by the governing body (council) of each community on recommendation of a committee of three, at least two of whom must be forest owners, assisted by the State forest supervisor in the community, or, if there is a supervisor, by another forester designated by the body in charge of forest affairs.

3. Regulations for the handling of protection forests are similarly adopted by the community council on recommendation of the forest supervisor, or of the forester appointed by the body in charge of forest affairs, after comment by the committee appointed to recommend the boundaries of protection forests. Before these regulations become valid they must be ratified by the king, which, of course, implies approval by the national forest service.

4. Community councils are also authorized to adopt regulations for the prevention of forest destruction in general. These regulations, which must be ratified by the king, apply to all privately owned forests in the community outside of homesteads. In addition to general rules for the handling of forests, they may contain special provisions, such as the following:

That different rules shall apply to cutting for sale, manufacture at industrial establishments, or export from the kingdom, and to cutting for other purposes.

That no green trees may be cut until all dry trees, tops, and waste have been utilized, so far as this material is serviceable for the purpose and can be taken without undue difficulty.

That burning of heather, juniper, or moor shall be forbidden except in cases where burning is approved by the forest inspector as a means of promoting forest growth.

That an assessment may be levied on the proceeds from timber cut for sale, manufacture by industrial establishments, or export from the kingdom, to be used for promoting the reproduction of the forest.

This assessment must be paid to the treasurer of the community, who deposits it at interest in an authorized savings bank to the credit of the forest owner concerned. Reimbursement from this deposit is made at regular intervals to the owner for his outlay in promoting the reproduction of the forest, and the balance is returned to him on certification by the county forester, or by another man familiar with forests, designated by the prefect of the county, that further work is no longer necessary.

5. In order to carry out the regulations, the community council is required to appoint a forest council of five residents of the district, at least three of whom must be forest owners. This forest council is charged with supervising the execution of the regulations, including the appointment of inspectors and the preparation of instructions for their guidance. These inspectors are paid by the community concerned, one-half of the amount so paid being refunded by the State treasury. In addition, the regulations may provide that forest owners must pay the inspector who handles the marking, instructions, or other similar work for them.

6. In all forests not subject to public control under regulations adopted by the local communities the cutting for sale or industrial use of coniferous trees less than 20 centimeters (nearly 8 inches) in maximum diameter outside of the bark at 1½ meters (nearly 5 feet) above the root collar is prohibited. Exceptions are, however, made in the case of dead, windfallen, suppressed, unthrifty, or damaged trees or trees which should be cut for the good of the forest. These can be removed after designation by a State forest supervisor or county forester, or one of their assistants, or by one of the community inspectors. All such trees must be marked on root collar and trunk with a marking axe approved by the community council or by the county forestry society.

7. In order to carry out this general provision, the community council is required to apppoint a forest council consisting of five residents of the community, at least three of whom must be forest owners, or to serve itself as the forest council. This forest council must see that the law is carried into effect and must report violations to the police. For this purpose it appoints the necessary number of inspectors and prepares instructions for them. The council must be notified of every cutting for sale or industrial use at least 14 days before marking, or, when marking is not to be employed, before cutting is started. Whoever carries out the marking or gives instructions has the right to require the leaving of such trees

as are necessary for shelter or seed. The salary of the inspectors appointed by the forest council is paid from the treasury of the community, one-half of the amount paid being later refunded from the State treasury. In addition, forest owners are obliged to pay the inspector who handles the marking, instructions, or other similar work, at a rate fixed by the governing body of the community.

8. Neither the special regulations adopted by the local communities nor the general regulation mentioned in paragraph 6 apply to forests under public management; to district commons managed under rules prescribed by the body in charge of forest affairs and under supervision approved by it; or to land cleared for gardens, agricultural crops, or hay fields, or used for building sites, roads, industrial establishments, or storage places.

In short, the legislation at present in effect in Norway provides for public control of all privately owned coniferous forests, which constitute 75 per cent of the forest area of the country, and by far the most important stands, both from a protection and a production standpoint. This control is exercised by the local communities so far as they are sufficiently interested to adopt the necessary regulations. At the close of 1916, 261 communities, or somewhat less than one-half of the 550 forest communities in the country, had adopted such regulations. Of these 80 applied to protection forests only, while the remaining 181 applied to forests in general. In the absence of such special regulations control is exercised under the general regulation prohibiting the cutting of coniferous trees less than 20 centimeters (8 inches) in diameter. Salaries for the inspectors appointed to carry out either the special or general regulations are paid in part by the local community, in part by the State, and in part by the private owner.

Mr. Anton Smitt, the Norwegian forester who visited this country in 1916 to collect seed for experimental use in western Norway, has offered a number of interesting criticisms of the legislation now in effect. In his judgment, the provision forbidding the cutting of all trees under 20 centimeters in diameter is at the same time the strongest and the weakest point in the law. The weakness lies in the fact that the ordinary man concludes that when the State fixes a minimum diameter limit in this way, no damage is done if *all* trees above this diameter are cut. Norwegian foresters consequently believe that the law should be amended so as to provide that cutting can be done only after designation by a publicly appointed or approved forester.

Another weak point in the law is the provision for inspection, since the present wording permits the appointment of inspectors without

the necessary technical education to handle the work properly. As a result the inspectors are most often only ordinary forest workers or some of the district's *smaller* forest owners. Mr. Smitt further believes that the law is weak in not excepting from the operation of the law forests under complete professional management, as was done in the law of July 20, 1893. The present law, on the other hand, makes all private forests subject to the control of the inspector of county forester concerned. These are often less capable of handling the forests properly than the men employed by the private owners, since many of the best foresters in the country are now in private employ.

Still another weakness is in the provision exempting from the general provisions of the law of June 7, 1916, forests for which special regulations have been prepared by local communities. While this makes it possible for the communities to adopt more drastic regulations for the handling of private forests than those contained in the law of 1916, and to except forests under professional management, it does not compel them to do so, and as the law now stands it is entirely possible for them to adopt less effective regulations.

Mr. Smitt does not regard either the Swedish or the Norwegian law as at present satisfactory or up-to-date. The Norwegian law, however, has the advantage that to a certain degree it protects the mountain forests, which the Swedish law does not do. The latter enjoins only the duty of reforestation, but every one knows how difficult it is to secure the carrying out of cultural measures high in the mountains.

In spite of its shortcomings, the Norwegian law is far in advance of anything that has been adopted, or even seriously considered, in this country in the way of public control of private forests. Yet the reasons for exercising such control are fully as strong in this country as in Norway. The legislation was passed in that country for the obvious reason that forests, with their annual production of about $50,000,000—exceeded only by the production of agricultural crops—constitute a resource that the community cannot afford to neglect. It is, therefore, accepted practically without question that it would be folly for the community to allow a resource of such importance to be destroyed or even seriously misused. Forest owners are said to be among the first to agree to this point of view, but usually believe that they are already handling their forests in as satisfactory a manner as possible under existing conditions. Is not the case almost precisely similar in this country? The need for the conservation of the forests as one of our basic resources is recognized by practically every one.

including forest owners and lumbermen generally, but forest conservation is not practiced because owners either mistakenly believe that they are already handling their property satisfactorily or that under existing conditions it is impossible for them to do so. If we are to make any real progress in bringing about a more rational handling of the bulk of our privately owned forest lands before it is too late, should we not consider carefully the advisability of following Norway's example in making such handling compulsory?

A FOREST POLICY FOR LOUISIANA

By R. D. Forbes

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When in January, 1917,[1] Dr. Fernow reviewed the forestry situation in the United States, he gave it as his opinion that but one State of the Union had developed "a really business-like forest policy and carried it practically to a tolerably worthy issue." This is a broad statement, and might not stand altogether unchallenged before a jury of State foresters. Certainly, Dr. Fernow had no idea in making this statement of charging 29 out of the 30 State foresters, then holding office, with failure to recognize the true objects of their work as foresters and, having formulated them, to strive doggedly and effectively toward their attainment. The very fact that Pennsylvania alone had developed a definite policy of State acquisition of true forest soils and undertaken upon them a continuous production of forest crops indicates the tremendous difficulties with which the State foresters of the country have had to cope in advocating this cardinal principle of forestry. The average State forestry department has been compelled by public apathy and misunderstanding to develop piecemeal and along the lines of the least resistance. Instead of being able at the first to place before the public the fact that the forest resources of the State were being rapidly depleted, and being able to offer, with some hope of adoption, a scheme for remedying the situation on a broad scale, the average State forester has been compelled to start at a point infinitely remote, and laboriously prepare the public mind for the adoption of the essential object of his work. That is why 29 of Dr. Fernow's 30 foresters, instead of being diligently employed with the problems of continuous forest production on true forest soils, publicly owned, are "puttering," as he puts it, on dendrological manuals; shade-tree work; illustrated lectures; supplying market data to the skittish lumberman or woodlot owner, who may by such insidious kindnesses be wooed away from the broad highway of forest destruction into the narrow and dim (oh, very dim!) paths of forest conservation; forest nurseries to supply planting stock for the artificial reforestation of one acre, where the crying need is for the natural reseeding of a thousand acres; establishing sylvan recreation

[1] The Situation, by B. E. Fernow, Jour. of For., Vol. XV, No. 1.

grounds for a public that promptly proceeds to peel all the bark off the trees, or burn the whole business up, or even endeavoring on a few thousand acres of "demonstration forest" to prove to an unimpressed public the quite undemonstrable proposition that because the State is growing trees on untaxed land at an annual cost of five or ten cents an acre for protection, to be repaid in the final harvest 50 years hence, it will assuredly pay the private forest land-owner to do likewise. Even fire protection, valuable and generally indispensable though it is, will sometimes seem to the impecunious State forester a useless outlay, when the private owner of the land he is protecting suddenly decides to log it clean of every valuable seed tree, and wandering cattle, goats, sheep, and hogs swarm to complete the destruction. Verily the path of the State forester is thorny—beset by the importunate office-seeker, pestered by sentimentalists and faddists, labeled as a visionary by the hard-headed lumberman, starved by a penny-wise and pound-foolish legislature, and in general buried under a mountain of public ignorance and apathy. That the State foresters have, almost without exception, stuck grimly at their posts and have been willing to "putter," if puttering was all that could be done and at least served to keep forestry before the public, is in itself proof of the high idealism of the trained forester. Would Mr. Kneipp's "practical forester" have stood the same gaff?

Louisiana, second of the Gulf Coast States to establish a State forestry department, stands today on the threshold of forestry work of a somewhere-near-adequate scale. Upon the groundwork laid by the pioneers is at last, we hope, to be laid a structure of large-scale accomplishment. Uniquely financed out of the profits of those making useful our great virgin forest resources, and legalized by a remarkably complete, although by no means perfect, set of forestry statutes, State forestry work in Louisiana under the State Department of Conservation is taking form. To have a part in rearing the structure is a privilege far outweighing the drawbacks that may exist and the disappointments that are bound to come. It is the object of this paper to sketch, after 14 months' study of Louisiana conditions, and, still more important, after consultation with those whose knowledge of Louisiana's forests is lifelong, a tentative plan for the State forestry edifice. In other words, I shall try to present the broader phases of what, in my estimation, is a proper State forest policy for Louisiana, to be carried out by the State Forester, working under the Commissioner of Conservation. Possibly such a statement, at the very initiation of the work, may serve to clarify and to keep clear our own vision as forestry officials, and

eventually, when placed before the public in final and simpler form, may work to spare us some of the puttering which a clouded public vision has forced older State forestry departments to indulge in.

The aim of forestry is to secure a continuous production of forest crops. To translate this from an academic proposition into a practical reality is, of course, the central object of a forest policy in Louisiana as in every other State. Such a translation requires an answer to the two questions: *Where* and *how* are we to secure this continuous production?

Ideally, no land should be devoted to the growing of forests, either permanent or temporary, which is capable at the time of more productive use. Let us consider the lands of Louisiana from the standpoint of their value for agriculture, live-stock production, and forest growth. The small areas more valuable for mineral use may be left out of consideration. Louisiana was classified by Hilgard, and later by Dr. W. C. Stubbs, many years ago, on the basis of vegetation, into eight types, and these were reduced by combination to six by J. H. Foster, in his examination of our forest resources, in 1912.[2] These latter are as follows: Sea marsh, of course treeless; prairie region, likewise nearly treeless; alluvial region, including the cypress and tupelo deep swamps, permanently wet, and the swampy areas, originally periodically overflowed, bordering all the large streams; bluff region, intermediate in topography and soil value between the alluvial and shortleaf-pine regions, and characterized by hardwood growth chiefly; shortleaf-pine uplands, where the dominant species are shortleaf and loblolly pines and upland hardwoods; and the longleaf-pine region, including both flats and hills. A rough estimate of the percentage of each type now cultivated or in permanent, fenced pasture, and of the percentage capable of cultivation, if judged solely from the standpoint of soil fertility and topography, has been obtained from the officials of the co-operative farm-extension bureau at Baton Rouge and is given in the following table. These officials would be the last to claim exactitude for their figures, which will nevertheless serve in the absence of any more careful estimate.

The question of fitness for range grazing may be covered in a sentence; there is scarcely any portion of the State that does not now afford range grazing and could not be made into at least fair pasture, good for 6 to 9 months of the year, by a systematic policy of seeding to valuable species of grass, legumes, etc., followed by fire protection.

[2] Bulletin 114, Forest Service, U. S. Dept. of Agriculture, by J. H. Foster.

Region.	Acreage.	Cultivated or pastured.		Cultivable.		Non-cultivable.	
		Acreage.	Per cent.	Acreage.	Per cent.	Acreage.	Per cent.
Longleaf ..	6,244,000	437,080	7	4,683,000	75	1,561,000	25
Shortleaf ..	5,320,000	1,330,000	25	4,788,000	90	532,000	10
Alluvial ...	8,428,000	2,528,400	30	7,585,200	90	842,800	10
Bluff	1,232,000	554,400	45	985,600	80	246,400	20
Prairie	2,548,000	2,038,400	80	2,293,200	90	254,800	10
Sea marsh .	4,228,000	42,280	1	3,171,000	75	1,057,000	25
The State..	28,000,000	6,930,560	25	23,506,000	84	4,494,000	16

Like most statistics, these figures are very misleading without further explanation, because the factor of drainage has been left out of account, and in two large regions it is the all-important factor. Conditions in each region may be described as follows:

Sea Marsh.—Beyond a doubt, this will be the last region to be developed for farms and pastures, owing to the fact that it is subject to salt-water overflow periodically, when certain combinations of wind and currents drive the waters of the Gulf over it. When the demand for agricultural land in Louisiana has reached the point which in Holland justified the diking of the Zuyder Zee this region will be reclaimed. Limited areas have been reclaimed by private capital in the past, and undoubtedly will be in the future, but the great bulk can never be reclaimed except as a public enterprise. So little is known of the soils of this now nearly unutilized region that an estimate of the percentage of non-agricultural land is purely a guess. In small areas certain soils of very deep vegetable muck or peaty material, apparently occupying the sites of ancient bayous, have defied the skill of agricultural experts to restore to agricultural productiveness after about five years of cropping. No chemical applications have served to counteract what appears to be the accumulation of vegetable poisons produced by growing crops; possibly trees may be induced to grow on such soils when farm crops will not, but no experiments have been conducted along this line so far as known.

Prairie.—This region is the great producer of rice, sugar-cane, and similar crops. The large percentage already in agricultural use is the result of natural fertility and freedom from stumps, the removal of which would retard development.

Bluff Region.—The soils of this region are of wind origin and are very productive. The non-agricultural portions—10 per cent of the total—are such because of broken topography, some of the roughest

land in Louisiana being included in this region east of the Mississippi River and along the State line.

Alluvial Region.—So far as the composition of the soil goes, no richer lands than those of this region exist in America. Hundreds of thousands of acres of "front lands," or natural levees, bordering the rivers, being higher than the "back lands" more remote from the channels, are above ordinary high-water level, and have been further protected against the worst floods by artificial levees. The back lands, however, are overflowed a few times every ordinary year by the backing up of water from the larger rivers into the maze of anastomosing tributary bayous that drain the region and whose currents run sometimes one way, sometimes the other. To drain them and to levee or dam the outlets of the smaller streams as a protection against back water is a very expensive process, and except for certain occasional units of rather higher land the back lands as a whole can hardly be reclaimed by any other agency than the State or Federal Government. The ownership, as a rule, is badly scattered. Some of the deep swamps along portions of the Red, Ouachita, and Atchafalaya rivers, still without artificial levees, overflow to a depth of 12 or 15 feet, which indicates the extent of the drainage problem.

Shortleaf-pine Region.—Cultivation has been attempted of a good many areas in this region which are non-agricultural because of broken topography and which erode seriously in spite of terracing and contour plowing. The 10 per cent of non-agricultural land is largely of this character, and a much larger per cent ought not, it would seem, to be farmed in advance of the much richer soils of the bluff, prairie, and alluvial regions. The productive power of the average soil is the second lowest in any of the six regions. The non-agricultural land is pretty well scattered through the better land in small units, although some extensive areas occur without any admixture of better soils.

Longleaf-pine Region.—In spite of the fact that this region has, on the average, the poorest soils of the State, and but 7 per cent is now farmed, it is significant that only about 25 per cent of its area is estimated to be true forest soil. Some of the longleaf-pine hills have very abrupt slopes, especially where the breakoffs into the main streams occur, and these are non-agricultural. Again, certain areas of peculiar distribution, but of fair size, have deep sandy soils, underlaid only at depths of 18 inches to several feet by an impervious subsoil. Here a condition of physiological aridity, so far as ordinary shallow-rooting crops go, is in nowise a bar to fair growth by the deep-rooted longleaf pine. Aside from these broken areas and those of deep sand, both true

forest land, there are some less important areas whose topography and soil make them, at least temporarily, unfit for farming. The "gas mounds," or low mounds a hundred feet or so across, which are found scattered through regions without decided slopes, frequently impound water in the depressions separating them, and unless the soil is very fertile it does not pay, under present conditions, to do the leveling necessary to secure proper drainage; ordinary ditching cannot be done except at great expense, an outlet being required from each of the innumerable depressions. Stiff clays appearing on the surface in hilly areas and "crawfish land," white clays without easy drainage lying along small creeks that flood them at times, are also among the more nearly true forest soils. The non-agricultural lands scattered through the cultivable portions of the longleaf-pine region are in far larger units than in the shortleaf.

Summarizing the above, we find that only 7,000,000 acres in Louisiana are today cultivated or pastured, chiefly in the shortleaf, alluvial, bluff, and prairie regions; that 23,500,000 acres are cultivable, including 3,000,000 acres of sea marsh that can be drained only at enormous expense, and a considerable portion of the 7,600,000 acres of alluvial land which will require heavy investment in drainage systems before they can be reclaimed. The very attempt to express these conditions in figures, however approximate, as these frankly are, discloses our lack of definite knowledge on the subject and the necessity for learning more. Land classification, for the purpose of locating, as definitely and exactly as the present state of development warrants, the agricultural and non-agricultural areas in Louisiana, is very badly needed. Our present meager knowledge is sufficient to guide us only in the broadest way, as the descriptions above well indicate. We know, for instance, that deep sands are non-agricultural, but so far as being able to take a map of the State and outline upon it the areas of deep sand goes we are nearly ignorant. It is possible that the information may be obtainable locally in fragmentary form, but it has never been compiled, coordinated, and made available for use.

Pending more exact information, it is nevertheless worth while to consider, region by region, the true forest soils—temporary and permanent—of Louisiana, and in broad terms state for each how continuous forest production may be attained best, if at all.

Sea Marsh.—The possibility of putting any of this treeless region under forest growth is about as remote as the possibility of reclaiming it. The use of loblolly pine, which Mr. Zon reports to be marching

into the Gulf of Mexico in east Texas,[3] is scarcely worth speculation, and yet in it would appear to lie our greatest hope.

Prairie.—A treeless region, or nearly so, devoid of any considerable original stand and nearly all available for cultivation, this presents little of significance from the standpoint of forest production, although, as in various prairie States, planted groves to supply fuel, fence posts, etc., are increasing. As farm woodlands, susceptible to proper handling for continuous production, these plantations and the few patches of woods which originally existed and may have been preserved are of interest to the Department of Conservation, and it should be part of the State policy to encourage in every way their preservation and proper handling by the owners. Fire protection will be, of course, an unknown worry in the region.

Bluff Region.—Ill-advised removal of forest growth in this region appears to be more dangerous than in any other type (except perhaps the shortleaf-pine region) on account of causing erosion. The finely textured æolian soils of the region wash readily, and in places, as along the main streams, the slopes are very abrupt. Some of the oldest agricultural plantations in the State lie in the region (West Feliciana Parish), and the ownership of land is well divided. This latter fact, together with the local distribution of uncultivable areas, scattered in small bodies through the rich agricultural land, points to a breaking up of the timbered areas into farm woodlands, of course, in private ownership. The demand for forest products, such as fuel and posts, will be increasingly good as the virgin timber of adjoining regions becomes scarcer and the present rapid development of farms in this region continues. As in the prairies, fire protection is already in large measure, and in the future will be entirely, assured by the smallness and isolation of the forest areas.

Alluvial Region.—The vast areas of back lands in this region will not be reclaimed for at least a generation, and as logging in the type is apt to leave a few seed trees at least of tuplo, a light seeded species, natural reproduction is easy, as a rule. Furthermore, except in a most unusual year like 1917, the periodic overflows totally prevent fires. If the soils themselves were true forest soils, State ownership would be advisable to prevent the owners, under the pressure of taxes and the necessity for immediate returns, from cutting clean in the young second-growth stands as soon as they have produced fuel, posts, piling, and other small material, instead of waiting for the greater ultimate returns in the form of sawlogs. But although opinions differ as to

[3] The Loblolly Pine in East Texas, Bul. 64, U. S. Forest Service.

whether the agricultural development of the tremendously fertile soils of this region, at great expense for drainage, will follow or precede the like development of the far less fertile piney woods soils, which especially in the shortleaf region (where stumps are no great problem because of rapid decay) require relatively small investment to put in shape for the plow, it is certain that the deep swamps of the alluvial regions will some day be reclaimed for farming. Under these circumstances forest growth, assured as it is by natural conditions, will continue under private ownership for a generation or more, at the end of which period it will be succeeded by farm crops. Then will be time enough to decide whether it is economically more sound to advocate a farm woodland for each plantation—remembering that this region is the American Valley of the Nile in agricultural productiveness—or to depend upon the near-by true forest soils of the State for fuel and other products needed on the plantation.

Something will be said later of the value of State ownership of true forest soils in the pine regions as a bar to attempts by land speculators to peddle such soils off as agricultural, to the great detriment of the proper development of our better soils. In the alluvial region public ownership is not as necessary to combat this evil, for it requires a pretty unwary investor to be persuaded that land three feet under water is good farm land. And the water mark on the trees can't be conveniently obliterated!

Within this region there is a really considerable body of non-agricultural land lying in strips along the chief streams between the top of the levees and the normal high-water mark. This land should be well adapted to the commercial growing of cottonwood or willow.[4] These are cheaply planted from cuttings, and inasmuch as the land, although, strictly speaking, in private ownership, is untaxed, there seems some possibility of interesting owners in commercial plantations. The State's interest in the resultant protection to the levees should warrant it in supplying the necessary planting stock.

Shortleaf-pine Region.—In spite of the fact that roughness of topography is a general condition over this region, several factors combine to indicate it now and in the future as a region of farm woodlands. One of the oldest railroads in the State, along which a number of thriving towns and cities are located, crosses the main body from east to west, and it is well served with railroads throughout; much of the original virgin timber was logged years before the longleaf-pine opera-

[4] See Cottonwood in the Mississippi Valley, Bul. 24, U. S. Dept. of Agriculture, Forest Service, by A. W. Williamson.

tions further south came into full swing; the shortleaf, loblolly, and hardwood stumps are easily disposed of. All of these factors, together with some others, have produced a rather early development of farming and stock-raising. These in turn have resulted in a wide distribution of farms, and the building of numerous roads, which break up the region into small units and keep down forest fires. Cutting was not close and left many seed trees. Second-growth timber is therefore plentiful, and in many cases is already being cut by small mills. With but 10 per cent of non-agricultural soils, this region demands of the State forestry organizations little beyond advice on farm woodlands and a certain amount of help in fire protection. This is for the region as a whole, where the non-agricultural land, so classed because of topography for the most part, is scattered through the better land in small units. There are probably a few parishes where broader areas of very rough land prescribe a different forest policy similar to that for the longleaf-pine region.

It is just possible that with the gradual progress of education in forest values a few large owners in this region will be encouraged by the tax-abatement feature of the Louisiana forest law to undertake reforestation or continuous forest production. At present but two owners, and those closely associated, have taken advantage of the very liberal statute which lowers the tax assessment to $1 an acre for a period of thirty to forty years on land not now assessed at more than $5, and which the owner undertakes, by contract with the Department of Conservation, to reforest with valuable timber trees. The tracts in question are in the longleaf-pine region, and the owner of the main tract is able to anticipate continuous operation of his mill by reason of possession of a fifteen years' supply of virgin longleaf, several old fields stocked with loblolly and shortleaf pine now thirty or forty years old, and a large acreage of mixed pine land cut over fifteen to twenty years ago, when only the larger timber was utilized and the remainder—seven or eight trees to the acre—were left to put on diameter rapidly and to scale several thousand feet per acre by the time cutting again reaches them. Although there is much second-growth pine in the shortleaf-pine region, this combination of circumstances is little likely to be met with either in that region or elsewhere in the State (is there any other instance, even in the United States, where a lumber or pulp company owns a significant amount of young timber or middle-age classes?), and without them few private land-owners are likely to undertake forestry on a considerable scale. Nevertheless, the possi-

bility of accomplishing something in this way through private owners should by no means be overlooked.

Longleaf-pine Region.—It is in this region that the State has the heaviest responsibilities. The percentage of true forest soils is higher than for any region for which even approximate data in this regard is available, and large units of non-agricultural land here occur. Forest fires in this region reach their most destructive frequency. Immense holdings in private ownership, as in contrast to the dispersed ownership in other regions, are the rule. In spite of the cleanness and destructiveness in late years of power logging (as it is commonly done, though Hardtner has demonstrated that it can be conducted otherwise) there are still great areas of cut-over lands amply supplied with seed trees, which require little beyond fire protection to reseed satisfactorily. Locally hogs prohibit reproduction, but we are coming more and more to realize that as an enemy of second-growth the hog does not compare with fire.

Before an audience of foresters it is hardly necessary to present any arguments in favor of State acquisition and permanent ownership of the 1,500,000 acres of true forest land in this region. Moreover, as it happens that fires are most numerous and destructive in the longleaf-pine region, it is plainly part of a rational forest policy to put our greatest efforts in fire protection into this region, and within the region to give the greatest measure of protection to the poorer lands, which are unfitted for farming, and to such of the better lands as have sufficient seed trees to reseed satisfactorily. At least one, and possibly more, forest crops can be raised before much of even the better land in this region is in real demand for farming, unless it has such advantages as great accessibility and unusual or near-by markets.

No special conditions exist which modify the desirability or necessity of State ownership of the larger bodies of non-agricultural land in Louisiana. If it is argued that this land is of value for stock-raising, and should not therefore be considered true forest soil, in the sense that it is of value only for forest production, the reply is twofold: First, that if the entire acreage of non-cultivable soils (exclusive of that in the two treeless types, which can scarcely be counted upon for forest production were to be devoted to growing forest products to satisfy Louisiana's own future needs, it could not be considered an excessive per cent of the State's total acreage for this purpose—3,181,000 acres, or 11.3 per cent. Second, it may very well be questioned if the value of the land for range grazing begins to equal its value for forest production. A grazing fee of 25 cents an acre is, I am reliably

informed, all that the members of a certain large lumber association expect of their cut-over pine lands, and I doubt if such a fee can be obtained under present conditions for the best lands, to say nothing of the poorer. Certainly, the return per acre from such land if reforested, when reduced to an annual basis, is very greatly in excess of this, and under State ownership the necessity for an immediate annual return no longer exists. Furthermore, the grazing value is not wholly lost under reforestation, as a certain amount of forage will be produced in the young stands from one to ten years old, and again from perhaps the twentieth year on, when the crowns are high enough to admit some light. As for the argument that, granted fire protection, continuous forest production may be secured as well under private ownership as public, because of the easy natural reproduction and the fast growth of our commercial species, it falls down in the face of the undeniable fact that the life of the average pine operation in Louisiana is between five and ten years. It is ridiculous to expect that any lumber company will voluntarily start now to grow timber for future manufacture which will not mature until thirty or thirty-five years after its virgin timber is exhausted and its mill has closed down for want of raw material. Even if we could prove conclusively that the trees below, say eight inches, are logged at a loss and should be left for seed, we could not expect any private individual or corporation to long retain the land in forest while taxes and interest are piling up without any current return, except the small one from grazing, above referred to, and in the face of alluring possibilities of sale at an agricultural valuation. The economic pressure would be such as to force the cutting of any species before maturity, but the temptation to turpentine longleaf and slash pine at an early age would be irresistible. Conditions in portions of Florida beautifully illustrate this truth.

Far from there being any conditions modifying the necessity for State ownership, there is one condition which particularly emphasizes it. As in the Lake States, the non-agricultural character of the land is not apparent from the topography or from a superficial examination of the soil. Already the land speculator is abroad in the State. State acquisition of our non-agricultural land is the only sure way of preventing its sale to ignorant colonists, whose inevitable failure is bound to injure the State's reputation as an agricultural one.

Where and how to secure a continuous production of forest crops in Louisiana may then be briefly answered in the enunciation of the following State forest policy. The Department of Conservation should—

(1) Encourage and advise in the proper handling under private

ownership of the farm woodlands of the State, chiefly in the prairie, bluff, and shortleaf-pine regions; encourage, also, the practice of forestry on large units of private land, under the tax-abatement law, in the shortleaf and longleaf pine regions;

(2) Protect against fire the longleaf and a portion of the shortleaf pine regions, and

(3) Acquire for permanent State ownership and administer as State forests the true forest soils of the longleaf-pine region and of the shortleaf-pine region wherever occurring in units of administrative size.

As these policies are stated, they inevitably require a knowledge of our soils, obtainable only through land classification.

Upon our ability to make all of the work which we may undertake in Louisiana count toward the attainment of the objects set before us in the forest policy thus stated would seem to depend the success of the State forestry organization. The work done up to 1918 by the department consisted of a general propaganda preached by the commissioner himself and by the conservation agents, paid out of fish and game licenses, and the establishment of the Urania Forest Preserve under co-operative agreement with the Urania Lumber Company. During 1918, when the forestry law of 1916 first became effective and gave the department a portion of the severance tax on timber and turpentine, the forestry work was expanded, under the direction of a trained forester, to include the beginning of a State fire-protective system, and a general survey of the forestry needs of the State was made. Approximately $12,000 was spent for all purposes during 1918, half of which was provided out of the general fund of the department, the severance tax collections being temporarily far below expectations; $1,400 of Federal funds and $8,000 of State funds were spent for fire protection. Passage was secured of a law providing for the administration as a State forest of an existing game preserve of some six thousand acres, but the State's title to the land has been questioned and the matter is in abeyance. Propaganda and the slow process of education have been continued. Having made a good start, the department looks forward to increasing usefulness in the field of forestry during the years before it.

AËRIAL PHOTOGRAPHY AND NATIONAL FOREST MAPPING

By Rolph Thelen

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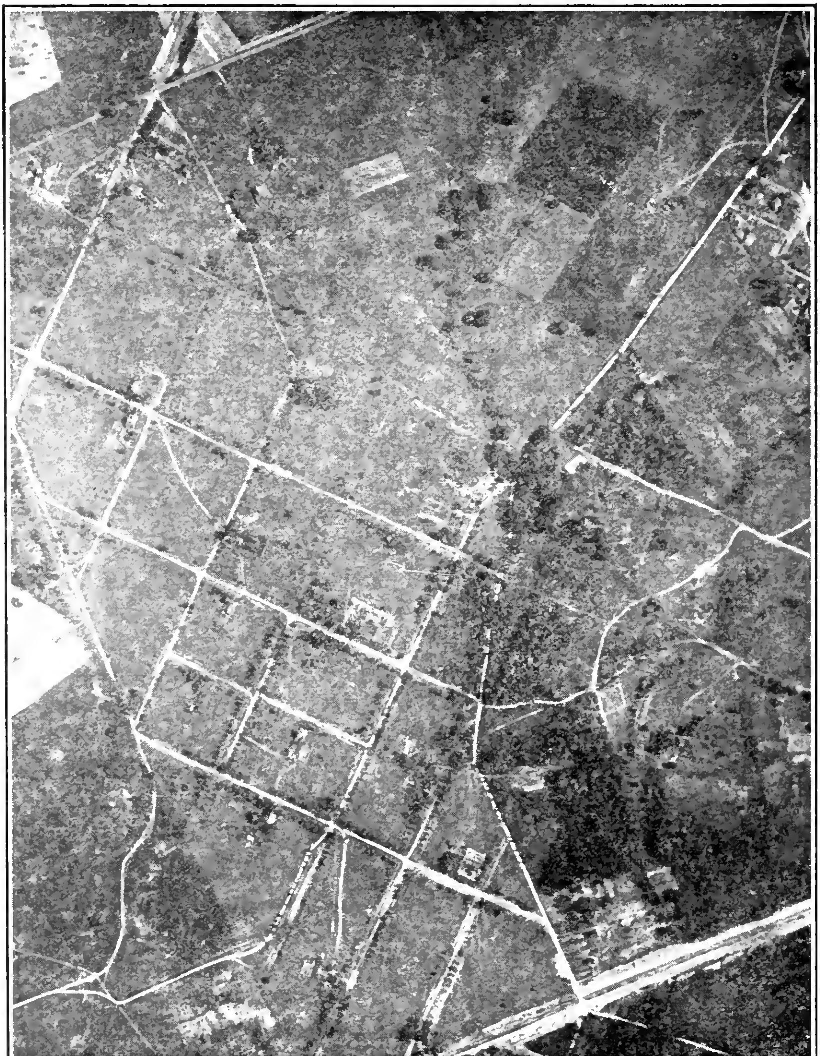
The development of aërial photography as a highly important and indispensable phase of modern warfare has been one of the many wonders of the great war. Photographic reconnaissance was practically unthought of during the early stages of the conflict, and may be said to have been an outcome of trench warfare. At the time the United States entered the war this art had already become of tremendous importance, and in the final stages a complete detailed photographic map of each sector had to be made daily. General Squier states that the British army made 17,000 photographs before the operations at St. Quentin in order that a relief map of the whole sector might be prepared before undertaking the drive.

Military maps of this character are commonly called mosaics, and are made as follows: An airplane (other forms of aircraft could be used under certain conditions) equipped with a magazine camera flies over the area to be mapped, maintaining as uniform an altitude as possible, and exposures are taken at the proper intervals to insure a sufficient overlapping of the resulting negatives. If the area is too wide to be mapped in one flight, a number of parallel flights must be made, and the negatives of each succeeding flight must overlap those of the previous flight. After the negatives have been developed, prints are made from them. If the accuracy of the map warrants it, the prints are all made to the same scale; this is done by making them in an enlarging camera instead of by contact. Distortion, caused by obliquity of the plate at the instant of exposure, can also be corrected in the enlarging camera if proper base points are available. The cameras are usually rigidly attached to the planes, and since it is impossible to fly continuously on an absolutely even keel, a certain amount of distortion is bound to occur. After the prints are made, they are matched up, trimmed, and assembled into the finished mosaic. It is obvious that in the case of flat terrain it is possible by this means to produce an accurate scale map. However, in the case of mountainous country, this is not possible, since the scale will vary unevenly throughout the negative with variations in elevation. Thus a

peak will be abnormally large in scale compared with a valley appearing in the same photograph, since it will be nearer the camera in eleva-



tion at the instant of exposure. The summit will be large scale, the valley small scale, and the slopes on various intervening scales.

In spite of this undesirable feature, this type of map answers military requirements admirably, especially when accurate scale maps of

the region are available, as was the case in France, and the main need for the photographic maps is to show the activities of the enemy. Points on the photographs can be tied in with the corresponding points on the scale maps, and the desired amount of detail filled in with almost any degree of accuracy. The speed with which aërial mosaics can be made is remarkable. The Division of Military Aëronautics recently made a mosaic of the city of Washington and surrounding country (see illustration on opposite page) in a total flying time of only 2¼ hours. The area covered was 27 square miles.

The possibility of producing accurate topographic maps from photographs has been appreciated for many years, and the camera has been used for topographic surveys to a limited extent in India, France, and Italy, and almost exclusively in the Dominion of Canada. Cameras used for this purpose are known as photo-theodolites, and are equipped with suitable cross-hairs leveling devices, horizontal scale, and magnetic compass, as well as with a small telescope for the reading of vertical angles.

In mapping an area, suitable camera stations are selected and their exact geographic location determined by means of primary or secondary triangulations or by other suitable method of survey, and overlapping views of the area are then taken from each camera station. From the data obtained it is possible to construct on the drawing-boards an accurate topographic map.

It would likewise be possible to construct topographic maps from aërial photographs, if certain necessary conditions were complied with. These conditions are, briefly, as follows:

1. The camera plate must be truly horizontal when the exposure is made.

2. The optical center of the negative must be determinate.

3. The overlap between successive negatives must be great enough so that the point on the ground lying in the optical axis of one negative appears in both the preceding and succeeding negatives.

4. The exact height of the camera above the ground at the instant of exposure must be determinate.

5. The whole survey must be tied in by base points of known geographical location.

Several makes of aërial camera have been developed for this class of work. They are arranged for flexible suspension in the airplane, and means are provided for keeping them vertical during flight. These means consist of gyroscopic control or suitably cushioned pendulum or plumb-bob action.

The trace of the optical axis of the lens on the plate may be readily determined by means of cross-hairs or similar intersection.

In order to secure the proper interval between exposures, so that condition 3 may be met, cameras are made either semi-automatic or fully automatic, and provision made to time the interval between exposures to accord with the speed and altitude of the flight, the focal length of the lens, and other conditions.

In order that the exact height of the camera above the ground (condition 4) may be determined, recourse will in general need to be had to some type of preliminary survey. There are several ways in which the desired object may be attained. Thus, if the relative height and horizontal distance between two points appearing in two consecutive negatives be known, it is possible, by geometric projection, to locate the position of the camera relative to these points at the instants these negatives were taken, and similarly determine the relative heights and horizontal distances of all other points in the area covered by both negatives. Further, if the exact geographic positions of the base points be known, the geographic position of each point in the area can be determined. It is not necessary to know the geographic positions of the individual base points, however, since the whole survey can be based upon suitable benchmarks at the beginning and tied in with others at the end. The accuracy desired and other conditions will, of course, determine the exact method of procedure as regards control. In any event, it is evident that any kind of photographic surveying must be supplemented by a certain amount of terrestrial instrument work, and, as in all surveying, the more control introduced the better the map.

While the method just outlined is perfectly workable, its accuracy depends upon many more or less uncontrollable factors, and it has not been developed to a point where it is possible to say just what accuracy may be obtained. One is quite safe in saying, however, that great difficulty would be encountered in making a 50-foot or 100-foot contour map of rough country by any method so far developed. Some of the reasons for this statement are as follows:

1. Even very slight divergence from the vertical in making an exposure would make a reasonably large error in the finished map. A 30-minute error from a height of a mile would displace the entire picture 45 feet and cause distortion on the entire plate.

2. Any shrinkage in the film or any lack of flatness at the time of exposure will produce highly magnified errors in the finished map.

3. Any errors in the lens will be magnified in the map.

4. The scale of the negative is relatively small, and the determina-

tion of the location of points by the method of intersections is inaccurate on this account and on account of the acute angles of the intersecting lines.

5. Errors are liable to creep in as a result of inaccurate determination of the same point on different negatives, owing to change of its aspect from the different angles of view.

It is probable that scale maps could be drafted from aërial photographs with reasonable speed.

One manufacturer states that in experiments conducted by him it has been possible for one draftsman to map ten square miles per day, with 700-foot contours. He believes that, with improved transposing instruments, 25 square miles per day could be mapped.

It is probable that the sketching of contours and the determination of various topographic features could be assisted materially by the use of stereoscopic views and a stereo-comparator, an instrument used to determine relative depths in stereoscopic views. Oblique views, properly chosen, would also be of assistance in determining topography.

National Forest maps are made and used for many purposes, and their character varies with the use to which they are to be put, ranging from the crudest sketch to contour maps of high accuracy. In many cases these maps are compiled from all the best surveys available, and recourse is had, not only to Forest Service data, but also to maps and surveys of the General Land Office, the U. S. Geological Survey, the U. S. Coast and Geodetic Survey, and infrequently to the work of corporations or local surveyors. On some National Forests the amount and grade of existing surveys are much below the needs. Where the desired surveys and maps do not exist, it becomes necessary for the Forest Service to make the proper survey. This is especially the case when topographic maps are needed in the appraisal of timber and forage.

For the purpose of this article, Forest Service surveys may be classed as follows, the principal uses to which each is put being shown as subheads:

1. Cadastral Surveys:
    - Boundaries and acquisition.
    - Entry surveys.
    - Administrative mapping.
2. Topographic Surveys:
    - Timber reconnaissance.
    - Grazing reconnaissance.
    - Soil reconnaissance.
3. Engineering Surveys:
    - Road construction.

At present we have cadastral maps of all National Forests, mainly compiled from General Land Office surveys, and though their accuracy and the amount of detail shown sometimes are not all that they should be, yet in general these maps are sufficient for ordinary purposes.

Topographic maps of perhaps one-half of the National Forest lands already exist, mostly on rather small scale for administrative purposes. These maps are utilized as far as possible as the basis for extensive timber reconnaissance, grazing reconnaissance, engineering plans and estimates, and many other important National Forest activities. But the more intensive timber reconnaissance, and certain other projects as well, demand topographic maps of fairly large scale and showing much detail. If not available, they must be made before the project is finished. For engineering construction, particularly, the control also must be reliable, or wasteful expenditures might easily result.

In the standard Forest Service method of making an intensive timber reconnaissance two things are necessary: (1) to determine the exact stand and yield on certain sample strips, and (2) to estimate the character of the forest cover on the entire area. From this an accurate estimate of the stand and yield on the entire area is obtained. In practice, the party goes through with compass and chain, running parallel strips 1/12 mile apart throughout the entire area and measuring or estimating all trees in each strip. In case no good topographic survey of the area is in existence, a modified Abney level is used to determine the relative elevations every two chains along the strips, as well as prominent topographic features between the strips. All these data are tied in with points of known geographic location and elevation and the result is a topographic map on whatever scale is desired, the accuracy of which can be made much greater than that of maps ordinarily made with plane-table and alidade, because of the vastly greater number of points to which the control is carried. Thus the necessary, though secondary, feature of the topographic base map is obtained practically as a by-product of the labor of the timber estimators.

Extensive timber reconnaissance and grazing reconnaissance are usually made by other methods, which do not lend themselves as readily as the strip method to the systematic gathering of topographic data. Either the base map used is the General Land Office survey, or extensions of it, or else a topographic base is made with plane-table and alidade. The contour, as well as the boundaries of the areas under forage, are determined, and the amount of forage on the area determined by inspection of suitable units, such as sections or drainage basins.

Having briefly outlined the manner of making aërial photographs and

maps, sketched the requirements of National Forest surveys and reconnaissance and present methods of meeting the principal of these requirements, we may proceed to discuss the possible value of aërial photography as an adjunct or supplement to these methods.

Neither cadastral nor engineering surveys can be made by photography. They demand the setting of monuments and also a degree of precision which cannot be obtained by photographic methods, especially in regions of bold relief. Hence photography can never do away with this kind of work, but each may supplement the other in the making of a fine Forest map. Every corner set is an additional control point. Cadastral plats are weak in detail, which is difficult to secure by present methods. An aërial mosaic of the area could readily be tied in with the monuments, and would furnish any desired amount of detail which could be drawn in on the properly controlled base. Thus every road or trail, creek, river, fence, or building could be accurately located with the minimum of effort and expense in the field.

In intensive timber reconnaissance, it is obvious that aërial photography as now developed cannot replace present methods, since neither the species nor the dimensions of the timber could be determined. Further, aërial photography has not been developed to the point where it is possible to make topographic maps with a degree of accuracy approaching that secured by the standard Forest Service method employed in conjunction with intensive timber reconnaissance. An added difficulty is encountered in forested areas, in that the aërial photograph shows only the tops of the trees and not the ground underneath. However, an aërial mosaic would be a valuable supplement to an intensive reconnaissance in several ways. Possibly it would be of greatest assistance in furnishing an excellent check on the percentage of forested area and parks. The accuracy of the reconnaissance depends, of course, upon the accuracy with which this percentage is determined. In areas which are completely forested, the value of the mosaic for this purpose becomes very small. In any event, a mosaic would be of general assistance in working up the data into map form and would present a picture of the area in much greater detail than the standard topographic maps.

The usefulness of aërial maps in connection with grazing reconnaissance is more apparent than in the case of intensive timber reconnaissance. While ordinarily topographic maps form the basis of grazing reconnaissance, it frequently happens that such maps are not available, and it becomes necessary to make surveys before the reconnaissance can proceed. It is probable that in many cases of this sort aërial mosaics could be used as base maps. They would have the added advantage of

showing clearly the limits of grazing areas, making much easier the work of estimating the forage. This advantage is present even where there are topographic maps available, and might be great enough to warrant making aërial mosaics in connection with all grazing reconnaissance.

Likewise, in the case of extensive timber estimating, especially where suitable maps are not available, the aërial mosaic should be of great help. It would be accurate enough for all purposes and would show the boundaries of all timbered areas. Further, if stereoscopic pictures were made, a man familiar with the region could undoubtedly gain a very good idea of the actual stand from the photographs alone.

Finally, there are many areas in the heart of the National Forests on which no surveys or reconnaissances have been made, and, if the present methods are to be followed, it is probable that a large part of these areas cannot be mapped for many years to come. Mosaics of the lake and glacier regions might be of considerable value in the service work of promoting recreation uses of the Forests.

Aside from the several forms of reconnaissance, aërial mosaics or maps of the National Forests would be of assistance in various phases of forest administration. Thus the supervisor would undoubtedly find many uses for a map of this character in planning trails and roads, drift fences, and other grazing improvements, and in aiding tourists and others in finding their way about. In fire-fighting, large scale maps of the region in which the fire occurs should be of real help, especially if supplemented by aërial maps of the fire itself.

If aërial maps were made recurrently, they would afford the best possible permanent record of changes and improvements on the Forests.

In timber-sale work aërial photographs, whether in the form of maps or simply as oblique pictures, would add very materially to the value of the timber-sale prospectus, since they could be made to show with great clearness and remarkable detail the entire area under consideration.

While aërial mapping is as yet a practically undeveloped art, especially in its application to peace-time requirements, the writer feels that sufficient progress has already been made, and its possibilities as an aid to forest mapping and administration are sufficiently evident to warrant careful study and thorough experimental investigation, possibly in connection with the training of military aviators.

SUGGESTIONS FOR INSTRUCTION IN RANGE MANAGEMENT

By Arthur W. Sampson

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The advancement in forestry methods in this country during the past decade is very marked. That forest schools are deserving of much credit for this advancement requires no argument. An analysis of the motive force back of the development of improved forestry practice generally, and especially of the development of the more fundamental principles that are now being applied, places the college-bred forester in the forefront of achievements. The forester who succeeds must sooner or later assume great responsibility in the management of public property, the value of which can be only approximately estimated. Not only must he be prepared to manage forest resources on an immediate economical and business basis, but he must look ahead with a view toward continued production.

The forester, to be entirely successful, must be trained in all the major lines of forestry business, for upon his shoulders the responsibility of the future management of our forests will very largely rest. The majority of the forest schools have been making efforts to shape their courses to meet the new requirements. However, one highly important phase of forestry business, namely, *range and live-stock management*, has, up to the present time, been all but overlooked.

When one stops to consider that there is no other single activity on our National Forests that exercises so profound and immediate an influence upon the people of the communities adjacent to the Forests as does range and live-stock management, it is truly amazing that thoroughgoing courses in this field of activity have not long since been included in the curricula of the leading forest schools. Failure to include grazing courses in their curricula is no doubt largely accounted for by the fact that the science of range management has developed with unusual rapidity. Relatively little fundamental information in the handling of the broader range problems was available ten years ago; but, owing to the need for improved management of the range, many principles of far-reaching application have been developed.

Because of the relatively short life cycles of herbaceous vegetation, as compared with that of a forest cover, many highly fundamental principles in range management can be developed in a few years. For this reason the proper application of the principles is more fruitful of results in a short time than is the application of principles in forest management. On forests where grazing is important, the dependence of satisfactory timber production and the efficiency of important watersheds on the judicious management of the range is now fully appreciated. Indeed, forest utilization (including certain other phases ordinarily considered as the more strictly forestry activities, exclusive of grazing), owing to the prevailing economic conditions in the West, is so intimately associated with the proper cropping of the forage growth as to require serious consideration of the latter over approximately two-thirds of the National Forest lands. Further, on privately owned forest lands grazing is popular and beneficial not only because it affords a source of revenue during the time that the timber is developing, but also because it affords protection in the control of forest fires. Therefore the training of the professional forester can hardly be considered complete unless he is qualified to determine such questions, for example, as (1) when grazing will increase or decrease the total returns on forested lands, (2) the class of stock best suited to the particular conditions, and (3) the number of stock that a given area will safely carry, keeping in mind the maximum utilization of the herbage growth, yet cropping it on the basis of a sustained yield. Questions of this character have long been of paramount importance in the West; similar questions have already presented themselves in the East.

Aside from the application of the study of the subject of grazing to National Forest lands, there are reasons even more urgent than those presented to justify fundamental training in the line in question. Exclusive of the National Forest lands, there remained in January, 1917, approximately 225,000,000 acres of public domain lands—an area larger than that of Germany, France, and Belgium combined—that is subject to settlement. It is estimated that about one-tenth of this acreage may pass into private ownership within the next few years as a result of the enactment of the 640-acre homestead law. Owing to the low carrying capacity of these lands, it is practically certain that they will sooner or later be consolidated into large holdings. Their economic management is sure to create a keen demand for the services of range experts,[1] as well as an exceptional opportunity for men of such training

[1] During the past two years several persons formerly in the Forest Service, especially qualified in range technique, have accepted positions as managers of livestock enterprises.

to enter into live-stock production for themselves. Owing to the seriously overgrazed condition of the public-domain lands, due to the lack of control of live stock and the general recognition of the ever-increasing depletion of these vast areas on the part of the stockmen, it is practically certain that the remaining acreage will very soon come under the control of the Federal or the State Government,[2] or a homestead law so liberal in the matter of grazing will be enacted as to result in the remaining lands passing into private owneship. In any event, a great demand and opportunity for the range technician is assured.

According to the Federal statistics of 1917, there are 160,000,000 acres of unimproved farm land east of the Mississippi, a considerable part of which is at present grazed. The demand for increased production of meats and animal by-products in 1918 greatly stimulated grazing on these lands. With this demand constantly increasing, it is quite probable that the need for pasture on the privately owned eastern lands, as elsewhere, will be appreciably expanded in the near future. Also, live-stock production is certain to expand appreciably on the National Forests in the East. In fact, there is already considerable competition for range on much of the eastern Forest range, where numerous intricate and urgent grazing problems have already presented themselves for solution.

When it is recalled that the acreage upon which the live stock in this country is grazed is practically twice that of our improved farm property, the need for training men in the management of our grazing resources, the crop of which must be harvested annually or it is forever lost, requires no argument. It is a pressing requirement of the State and the Nation.

AUXILIARY COURSES

In the preparation of the syllabus for grazing courses, the writer has had in mind the training of two classes of men: (1) the pastoral technician, or grazing expert, and (2) the forest technician, or professionally trained forester. The grazing expert would be expected to cover the entire field of study as here proposed, while the forest expert would pursue only certain broad grazing subjects, the exact courses of which will be mentioned later.

The educational requirements for training in the profession of range management certainly should be equal to those for other scientific pro-

[2] Several live-stock associations and statesmen in western States have taken steps to procure Federal or State control of the remaining public-domain lands in order to prevent further demoralization of their live-stock interests.

fessions. In general, the requirements should correspond to those for the study of professional forestry. The requirements for the latter are discussed in detail in a paper entitled "Standardization of Instruction in Forestry,"[3] and hence only those courses which bear more or less directly on the practice of range management need be mentioned here. The following auxiliary subjects, including a statement to signify their application to the management of pasture lands, should be embraced in the curriculum:

Subject	*Application*
Botany	General management of all forage resources.
Taxonomy	Recognition of important, objectionable, and unimportant range plants.
Morphology (internal and external)	Structure pertinent to the forage value of plants and to revegetation.
Physiology	Response of growth and functions of plants to annual cropping.
Ecology	Relation of invasions and successions to range management.
Plant Pathology	Control of parasitic diseases inimical to forage production.
Zoölogy	General conception of animal life, animal relationship, and zoo-dynamics fundamentally essential to the study of entomology, veterinary science, etc.
Bacteriology	The application of soil flora to soil fertility and crop production.
Entomology	Classification and life history of insects, especially as related to the genera and species destructive to forage plants.
Chemistry	Constituent of plants and animals; comparative nutritive qualities of forage plants and concentrates; soil fertility requirements.
Geology (including soils)	Relation of soils to intensity of grazing, revegetation, erosion, etc.
Animal husbandry	Comparative value of feeds, computing rations, and suitability of the different breeds of live stock to the various conditions.
Genetics	Improvement in animals and plants through the application and control of the laws of heredity.
Veterinary Science	Control of diseases of domestic (range) stock; surgery in connection with live-stock production.
Civil Engineering	Fundamentals of surveying, map-making, and typing as related to range use and management.
Meteorology	Climatic phenomena in relation to crop production; climatic forecasts and climatic cycles.

Botany probably has the widest possibilities of application. This subject should include a study of the five subdivisions indicated, each of which should be preceded by at least one year's study of general (college) botany. A knowledge of botany is sure to have a telling effect ultimately on forage production and hence upon the live-stock

[3] Report of the Committee of the Conference of Forest Schools in the *Forest Quarterly*, 1912, Vol. X, No. 3, pp. 343-347.

industry; for the further development and stabilization of the industry is absolutely dependent upon an adequate and permanent supply of choice forage. Recognition of the identity of range species, their internal or external morphology, the laws that control the functions of growth and reproduction, and the ecological requirements of the different forage types is sure to affect the future production of pasture lands. Any plan of range management which aims to improve the carrying capacity of pastures must be based upon the fundamentals of botanical science.

Following the general instruction in zoölogy, a special course should be given in the history of the development of domestic live stock. Such a course should aim also to cover in detail the history of development, relationships, distribution, and life history of the more common predatory and game animals.

The general grounding in entomology should be followed by a special course in applied entomology, and should consider the identity and life history of the genera and species of insects that are commonly detrimental to forage and beef production. Special consideration should be given to such troublesome insects, for instance, as the bot fly and to ticks that prey on stock.

Following the general course in chemistry, which should include qualitative and quantitative analytical and organic work, a special course should be given in the determination of the chemical constituents of feeds and forage crops. While it should not be the aim to have the student become a full-fledged chemist, a course covering, let us say, one credit unit through a semester would suffice to familiarize the embryo range expert with the methods employed in making analyses of feeds and the preparation of forage samples for analysis.

The course in animal husbandry—genetics and veterinary science—should aim to offer special work in the application of principles to improve live-stock production. In animal husbandry, for instance, consideration should be given to the relative merits of the different breeds of live stock as related to climate, the temperament of different breeds of stock as affecting their relative adaptability on the range, maintenance ration requirements of animals, and the suitability of different kinds of concentrate feeds in the different localities, etc. The applied work in genetics should consider especially the question of breeding as related to the creation of improved strains of live stock, such, for instance, as cross-breeding in the development of the mutton type of sheep, the wool type, and the combined mutton and wool type. Likewise the study of veterinary science should include a consideration of

the life history and control of diseases common to live stock on the range.

Obviously a thoroughgoing course in civil engineering, including mechanical drawing, is of paramount importance to the range technician.

The meteorological work should consider the vegetative types and the chief crop-producing areas of the United States, followed by a study of the normal temperatures and of the precipitation of these areas, taking into account the barriers and the general trend of the high and low pressure phenomena and their relation to precipitation. Consideration should be given to the study of weather forecasts and to climatic cycles, so far as they influence forage and live-stock production, and to the recording and assembling of climatic data, especially with reference to determining the relation of climatic factors to plant growth and live-stock production. It would probably not be necessary to offer a special course in meteorology, as this work could be given either in connection with the study of plant ecology or in some related subject.

GRAZING COURSES PROPER

The curriculum here outlined is planned as a 4-year program.[4] The grazing courses proper aggregate 25 credit units. One unit is the equivalent of 3 hours and consists of one-hour recitation and 2 hours of side reading or laboratory work, or the equivalent thereof, for one semester.

I. *Range History and Economics* (Introduction to Grazing)[5]

A. History of the Range Industry.
B. The Economics of the Range. (Three credit units.)

There are certain historical events and fundamental economic principles bearing on public policies and legislation which should be taught early in the course. Range history should aim to show the development of the grazing industry from the advent of domestic stock on the range, through the "bonanza" period, to the present time. Range economics should aim to consider the range problem in its economic aspect and take into account the broader policies which have been designed to favor

[4] Aside from those who intend to enter the profession of range management or make the most of live-stock production on private lands, there is the Forest Ranger and the noncollege-bred man, who will require a short course in the subject of grazing. It should be the aim of schools teaching grazing to meet these requirements.

[5] Introductory to the pursuit of the first course, there is need for training along the line of pastoral management and in the fundamentals developed and their application to live-stock production and the interrelation of grazing subjects to other lines of training.

forage production and utilization, and the results that have been and may still be obtained through the various practices should be emphasized.

The course should comprise a discussion of the following:

A–1.—The native foraging animals and their relation to forage production. 2. Advent of domestic live stock and the rate of their introduction over the United States. 3. Range wars: (*a*) Their origin and results and (*b*) their suppression as a result of the creation of National Forests, the adoption of the pasture-leasing system, and to certain other conditions. 4. Policies concerning the administration of National Forest range and of grazing in relation to other Forest resources.

B–1.—(*a*) The requirements of our nation and other countries for meats and animal by-products. (*b*) Relation of National Forest range lands to adjacent grazing and farm lands and to the development of the country generally. 2. Forage crop areas of the United States and the distribution of range lands and forage resources of this country and elsewhere. 3. Improvement in the production of range forage due to the regulation of grazing and the application of these results to the management of public domain and other lands. 4. The curtailment of our public-domain pasture lands and the reduction in their carrying capacity, including a consideration of the land laws and legislation affecting the results. (Three credit units.)

A–1.—The decrease in the productivity of the range in the early eighties was due to a considerable extent to the grazing and trampling by vast numbers of native foraging animals. This was especially true prior to 1880, when it was estimated that not less than one hundred million buffalo or bison, wild horses, and elk dominated the pasture lands chiefly west of the 100th meridian. The forage consumed annually by these animals should be compared with that used by domestic stock today. The range laws of Nevada and other States, providing for the destruction of unbranded horses, and the results therefrom should be reviewed.

2. The numerous difficulties encountered in stocking the vast expanse of country west of the Mississippi and the factors responsible therefor should be brought out. In this connection the advent of domestic stock following the settlement of the Spaniards in the Southwest, and the influence of these animals on the promotion of the industry, should be reviewed, keeping in mind the inferior class of stock introduced. The lands upon which stock was first handled and the factors favoring the occupation of the lands should receive consideration. The live-stock

production in the eastern and in the western half of the United States at the present time should be carefully compared and reasons given for the wide variation found in live-stock numbers.

3. Range wars, due to controversy over range by cattle and sheep growers, aside from the troubles with the Indians, were the first really serious factor in live-stock expansion. The differences in viewpoint between the cattle growers and the sheep breeders should be fully explained. In this connection mention should be made of the intense feeling that was awakened by the grazing of migratory sheep and against the alien sheep interests. The ill results of the serious range wars which followed—the loss of human lives, destruction of live stock, and the serious devastation of the range—should be enumerated. The influence of the creation of the National Forests, the leasing of pasture lands owned by the railroads, etc., in the amicable settlement of range difficulties between cattle and sheep growers should be reviewed.

4. It should be recalled that from the very beginning the policy of the Forest Service was to consider the use of the range as a privilege instead of a right. The adoption of this policy cannot be commended too highly. In many instances European governments in the administration of their Forests failed to recognize the use of the range as a privilege; on the contrary, because of long usage of the forage by live stock, the practice of grazing and, indeed, of utilizing certain timber resources became a prescriptive or property right.[6]

The details of the prescriptive rights and the results of the practice of this system should be studied carefully. The policies controlling range use on Government forests in other countries should be reviewed in considerable detail. The advantages of the grazing *privilege* as compared with the *vested right* should be outlined. The consideration of the issuance of grazing privileges should include a discussion of the basic principles pertaining to the adoption of the individual permit system, the payment of a small fee, etc. It should be clearly shown why the range is not leased in the ordinary sense, and what the reason is for the grazing permit's being considered a personal privilege or license based upon the qualifications of the individual. The reasons why the Forest Service aims to extend to the local stockman and settler the use of the range and other Forest privileges that cannot be enjoyed by

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[6] These well-established prescriptive rights made it impossible adequately to control the grazing of live stock on the Forests, even though serious damage sometimes resulted therefrom. In some of the German States, for instance, it will be recalled that the origin of the property right dates back hundreds of years under the feudal system, to a time when both range and timber were abundant and of comparatively little value—a time when the large forested areas were held by the nobility, kings, and emperors as breeding grounds for game and for hunting.

the non-resident grazer should be made clear. The advantages of the Government's controlling the number of animals to be grazed, the season of grazing, the particular allotment to be grazed, and the detailed rules for salting, bedding, and the like, should be discussed in full. It should not be the aim here, however, to study grazing regulations as given in the Use Book. If such work is desired, it may be convenient to teach it in connection with some allied course, such, for instance, as "National Forest Administration."

B–1.—The value of meat in the diet of peoples of all nations, as well as the relative consumption of meats by different nations, should be accentuated. The importance of the National Forest range to meat production, particularly in what may be termed the "chief range States," should be discussed fully. Special reference should be made to the dependence on the Forest range of the use of the enormous expanse of winter-grazing lands adjacent to the Forests; also the possibility of economic production of grain and hay crops in communities remote from market centers only by marketing these crops through the medium of live stock. It should be shown that the agricultural development of many communities is very largely, if not entirely, dependent upon the proper utilization of the National Forest range.

2. The study of forage-crop areas should be general and not necessarily ecological in character, though, indeed, the climatic conditions, particularly the amount and the seasonal distribution of the precipitation and the temperature averages and extremes, should be touched upon. Only major regional divisions should here be considered. The forage resources and live-stock production in other countries should also be briefly reviewed.

3. The effect of the enforcement of grazing regulations on the National Forests, not only in the replacement of friction and bloodshed by constructive co-operation on the part of the stockmen, but in the increase of forage production and the proper protection of Forest resources generally, should be shown. The approximate increase in the productivity of the range since the lands were included in the National Forests should be shown statistically and otherwise. Other benefits resulting from regulated grazing, such, for instance, as the proper protection of the watersheds and the increased production in farm crops due to improved streamflow, should be mentioned.

The benefits of a leasing system, such as was adopted by the land-grant railroad companies, should also be recognized. This system, which was usually accompanied by the fencing of the lands, was of distinct benefit (1) in improving the productivity of the depleted pastures and (2) in increasing the profits from the live-stock business.

4. Conditions leading up to the enactment of the early homestead laws and to the adoption of the policies pertaining thereto should be reviewed. The effect (1) on the live-stock industry and (2) on the homeseeker of private ownership of the vast acreage of land formerly used exclusively for grazing should be clearly recognized. In this connection the acquisition of the lands for dry farming and the difficulties such enterprises have entailed both on the stockman and the farmer himself should also be recognized.

The conditions and policies leading to the enactment of the 640-acre grazing homestead law, being vital at this time, should be carefully studied. Since, with few exceptions, 640 acres are inadequate for the making of a reasonable living, there can be little doubt but that this act will result in the choicest of the remaining public domain passing into the hands of the "Land Kings." The influence on range improvement and meat production of the passing of these lands into the hands of large live-stock owners should be carefully analyzed. Private ownership of the public lands now open to entry under the 640-acre homestead act will ultimately result in appreciable improvement in their grazing capacity as compared with their present productivity and in better utilization. The enterprising stockman fully realizes that the future prosperity of his business is dependent upon the proper use of the forage resource.

II. *The Native, Cultivated, and Associated Pasture Plants*

> This subject divides itself naturally into three branches, namely: 1. The study of the native and cultivated forage plants. 2. Poisonous plants. 3. Mechanically injurious plants. (Five credit units.)

One of the first essentials in range management is familiarity with the plants that make up the cover, particularly the palatable species. The forage plants best suited to the different classes of stock, the species that may be relied upon to indicate improvement or deterioration of the range, and numerous other matters vital to the proper management of the range, can be definitely determined only through familiarity with the vegetation. Since practically every course in grazing is concerned more or less with some phase of the plant cover, this subject should be taught early in the curriculum, to be preceded by one year's study of general college botany and by at least one semester's work in plant physiology, ecology, and systematic botany.

1. The study of the chief native and cultivated forage plants should be preceded by a brief review of the distinguishing characteristics and

relative importance of the plant family or subfamily (tribes) which embrace the greater number of the more important palatable species, to be followed by a general discussion of the variation in the period of palatability of the different plant types, associations, etc. The principles determining palatability under the various conditions to the different classes of stock should be considered in detail.

Careful training should be given in the recognition of the more important genera, and to as great an extent as possible in the study of the more common and widely distributed forage species which the respective genera embrace. Because of their relatively high importance, as well as from an evolutionary standpoint, the grasses should be taken up first, to be followed by a study of the grasslike plants (*Carex*, *Juncus*, etc.) of the herbs other than grasses and grasslike plants, and finally of the shrubs.

The course should embrace some field-work and include a study of the more common and important species occurring locally. A number of the more important species, even if not occurring locally, should be studied either from dry material or, better still, from fresh material grown in the greenhouse or in a forage-plant nursery. The chief aim of the laboratory work, however, should be to familiarize the student with the more important forage genera, which could probably best be shown by means of lantern slides and drawings. In the study of genera special attention should be directed toward the recognition of characteristics upon which the more important, closely related genera, such, for instance, as the bluegrass (*Poa*) and the fescues (*Festuca*), the angelicas (*Angelica*) and poison hemlock (*Cicuta*), etc., are distinguished.[7] The lecture-work should aim to cover the relative economic value of the different genera, especially in relation to grazing, the total number of species embraced in a genus, and their general distribution. The more important species in each genus should be enumerated. The individual study of the most important species should consider: (1) The chief taxonomic characteristics and how the plant may be distinguished from the species commonly confused with it, (2) distribution, (3) growth requirements, reproduction, etc., and (4) the forage value for the different classes of stock at different seasons.

2. In the study of poisonous plants the generally accepted use of the term "poison" as applied to live stock should be defined, and a critical taxonomic study should be made of the chief genera and to a lesser extent of the poisonous species themselves. The economic aspect, such

[7] This course should be closely correlated with the studies in taxonomic botany and with plant physiology and ecology.

as annual losses due to poison plants, should be carefully considered. The plants should be enumerated and the family characteristics firmly fixed in the student's mind. Special consideration should be given to the recognition of the symptoms of the different classes of stock poisoned by the different plant species. The antidotes, including their preparation in the laboratory and methods of administering them, should be given consideration. Preventive measures, such as pertain to the management of stock and the range where poisonous plants prevail, should be very briefly reviewed, leaving a full discussion of the subject for a later course.

3. The study of mechanically injurious plants should be pursued in much the same way as that indicated for the poisonous plants. The annual loss and character of injury, as well as the species most troublesome, including their life history and the season when they are most troublesome, and the remedial measures should be discussed in full. As in the study of poison plants, preventive measures pertain chiefly to the management of the stock and hence should be considered in a later course.

III. *Management of the Range*

> 1. Suitability of range to different classes of stock. 2. Grazing periods and grazing capacity. 3. Natural and artificial reseeding. 4. Range improvement leading to the most efficient continued use of the forage crop. (Four credit units.)

Management of the range, broadly considered, embraces subjects which have to do with the improvement and maintenance of the forage crop—a consideration of the business aspect, looking toward a permanent live-stock industry, with a view of yielding maximum returns. While this subject, like that of "Management of Range Live Stock," which follows, is so broad as to involve a knowledge of practically all conditions which affect the grazing industry, the field can be fairly well covered by a careful consideration of the four topics given.

1. The selection of the class of stock best suited to a given range is often a determining factor in the success of the enterprise. Poor utilization of the forage crop, heavy live-stock losses, animals in poor flesh, a low percentage of increase in the offspring, and a light clip of wool are some of the bad results to be expected from the use of range by the wrong class of stock. The character of the forage, topographic features, climate, elevation, and abundance of water, including distance between watering places, are among the chief factors which determine the class of stock to be grazed.

The course on "Native Range Plants" should have made clear to the student what the forage preferences of the different classes of stock are; that goats do well on dense brush areas because browse feed is more palatable to this class of stock than to cattle, horses, and sheep.

The relation of class of stock to topography, climate, and elevation should include (1) the ease with which the different classes of stock climb, (2) the relative losses of the different live-stock classes due to sliding in localities where the slopes become icy, and (3) the diseases that are commonly influenced by the factors in question.

In considering the water facilities as related to the class of stock, the discussion should cover (1) the distance the different foraging animals can travel to water with good results both to stock and range at different times in the year, (2) the length of time stock can go without water at different seasons and on different classes or types of feed, and (3) the possibilities and cost of water development.

2. Premature grazing, too close cropping year after year, and too long a grazing season are the most common means of range abuse. The physiological effect of premature and too heavy grazing on the vegetation should be brought out in a fundamental way in much detail. The carrying capacity and "forage-acre" requirements of the different classes of stock on the broader forage types should be discussed in full. The conditions under which it is necessary in practice to crop the forage earlier or later than is desired from the viewpoint of the welfare of the range alone, as well as by the class of stock evidently not best suited to a given type, should be fully recognized.

3. The practicability of restoring the productivity of depleted ranges by natural and artificial reseeding has been amply demonstrated by the Forest Service. The fundamentals of revegetation should be preceded by a review of the condition of the Forest ranges when the National Forests were created, the present condition of the remaining public domain, and the factors that contributed to these conditions. The basic principles underlying the successful application of the deferred and rotation grazing system and the application of these researches to the different localities and to the various methods of handling stock should be brought out in detail. Special consideration should be given to the plants (and more especially to the genera embracing the important species) which may be used as indicators of range depletion as well as improvement in the forage crop.[8]

[8] Recent researches have brought out the fact that on badly managed ranges plant succession may be retrogressive. This phenomenon is clearly indicated by the establishment and rapid increase of a temporary type of vegetation.

In presenting this subject the principles of succession should be reviewed and, as stated, the place in the succession, at least of the more common genera, should be fully considered. As elsewhere, it should be the aim to present principles rather than facts.

4. The subject of range improvement should aim to cover fully all matters designed to favor the highest possible utilization of the forage crop, considered from the standpoint of a sustained yield. Accordingly, the course should discuss in detail the question of water development, including location of water, methods of water development, cost, etc., the use and construction of drift and division fences, corrals, pastures, the development of stock driveways and bridges, salting facilities, and certain other important phases of range husbandry.

In addition, the question of the control of live-stock losses from poison plants and from mechanically injurious species should receive full consideration, as should the economic aspect of grubbing, fencing, and other means of controlling the menace due to poisonous and other objectionable plants. The control of range-destroying rodents and other pests should also be covered.

IV. *Management of Range Live Stock* [9]

> 1. Handling live stock on the range, looking toward proper control in number and distribution of stock on the major range units and on allotments. 2. Judicious husbandry, such as salting, watering, breeding, branding, castrating, shearing, lambing, etc. 3. Control of live-stock losses caused (*a*) by poisonous plants and (*b*) by predatory animals. 4. Winter live-stock husbandry under range conditions, with special reference to handling, shelter, and supplemental or emergency feeding. (Four credit units.)

1. Control in the number and distribution of stock on the range is of primary importance, both from the viewpoint of the stock and of the forage crop. Obviously, the determination of the class of stock best suited to a given range and the period during which the lands are

[9] Like the curriculum proposed in the course on "Management of the Range," the subject of "Management of Range Live Stock" is so all-comprehensive and the topics to be discussed so numerous that some instructors may desire to cover the field in two courses. As a student, however, I well recall that a one-hour course, for example, accomplished relatively little; as a rule, a three-hour course accomplished well nigh twice as much as one offering but two credits. Academically, then, it seems desirable to the writer to handle the subject as here presented. It might appear logical also to include reconnaissance and the formulation of grazing working plans either in the subject "Management of the Range" or in "Management of Range Live Stock." Reconnaissance and the formulation of grazing working plans, however, are such important subjects and must be taken up in so comprehensive a way as to justify a separate course.

capable of supporting the animals cannot yield satisfactory results if the number of stock for any appreciable period is excessive and the animals are permitted to congregate too much in one place.

Because they are not under absolute control at all times, cattle and horses are inclined to drift on a favorite part of a range in numbers far in excess of its forage production, leaving much choice feed on the more remote sidehills and ridges. Stock often find their way to Forest ranges in numbers far in excess of that permitted. This leads to "round-ups," which result in excessive trampling of the range and undue handling of the stock.

The fencing of Forest boundaries, the judicious use of drift and division fences, the adoption of the tag system, proper distribution of salt, and suitable locations for the development of water are among the most reliable weapons with which to combat excessive drifting and uneven distribution of stock. In handling this subject the instructor should make ample use of topographic type maps and numerous special sketches to show the ideal toward which the range expert is working.

2. Care in the husbandry of range live stock should aim to determine not only the percentage of increase of the offspring that may reasonably be expected and the condition of flesh of the animals, but also to a considerable extent the maintenance of the forage crop. Little is to be accomplished, for instance, through the use of the latest approved salt receptacle and the selection of suitable salting places, which tend to attract stock to the ridges, sidehills, and other places otherwise not commonly grazed to capacity, if an ample supply of salt is not furnished and properly distributed when the herbage is in the proper stage of development for harvesting. The amount of salt required throughout the season for each animal should be determined in advance, and the amount and dates of its distribution in each salting place clearly indicated on a map or in some equally satisfactory way and the plan of distribution strictly carried out. The physiological effect on the animal of inadequate salt should be made clear.

The following syllabus is designed to cover the subject of the husbandry of range sheep. It is hoped that it may also serve as a guide in the development of a course to cover the husbandry of other classes of range stock:

A. *Range Sheep.*

- Lambing:
  - Methods.
  - Equipment.
  - Applicability of each system.
  - Care of lambs.

- Breeding:
  - Season.
  - Class of sire.
  - Cross-breeding.
    - Effect on wool and mutton.
  - Gestation period.
  - Number of males to females.
  - Maintaining the breeding herd.
- Wool:
  - Anatomy and classification of wool.
  - Shearing.
  - Marketing.
  - Demand.
- Marketing of stock:
  - Season.
  - Local sales.
  - Sales and market centers.
  - Prices.
  - Fattening.
- Dipping:
  - Object.
  - Season.
  - Dipping plant.
  - Materials used.
  - Cost.
  - Results.
- Castrating and docking:
  - Methods.
  - Season (fly time, inclement weather, etc.).
  - Age of animal.
  - Losses.
- Herding:
  - Methods.
  - Application of different methods.
  - Equipment.
  - Cost.
- Bedding.
- Salt and salting:
  - Influence of salt on health and action of animals.
  - Kind of salt.
  - How and when to supply salt.
  - Amount.

3. Control of live-stock losses must be accomplished chiefly through the recognition and suppression of poisonous plants, the control of predatory animals, diseases, and the prevention of undue exposure.

The practicability and methods of disposing of patches of poisonous plants, and indeed of fencing to prevent stock from grazing on poison-infested areas, should be fully discussed. The effect of various methods of handling the stock in controlling losses of stock should also be fully developed. The effects of such factors as excessive hunger, the use of established bed grounds, lack of ample salt, and an inadequate water supply on losses of stock from poisonous plants should be pointed out and methods of avoiding such conditions proposed. The fact that a plant toxic to one class of stock is not necessarily poisonous to another,

enumerating the species of such characteristics and the class of stock exempt from poisoning, should also be brought out.

The consideration of the predatory animal pest should include an estimate of the annual live-stock losses from this source, the animals of prey chiefly responsible for the losses, and the season when animals of prey are most active. The subject of preventive measures should include methods of handling the stock, with a view to minimizing the losses to the greatest extent possible, and the most approved methods of controlling the predatory animal pest. Accordingly, the course will require consideration of the habits and life history of the chief predatory animals.

4. Winter live-stock husbandry, while not strikingly different from that at other seasons, often requires special foresight regarding the types of forage to be grazed or reserved for future use. The short-grass type, for instance, may be most fully utilized when there is little or no snow on the ground; and while sheep probably do best at all times on an admixture of herb and browse plants, such a combination of feed is not always available. Hence, where the normal snowfall is heavy, it is important that some of the choicer browse range be reserved for use when the shorter feed is hidden by snow. Likewise the value of reserving feed in suitable places for protecting the animals against stormy periods should be shown. Therefore, the student should be made familiar with the more common forage types on the winter range in the different regions and the season of their greatest usefulness.

V. *Range Reconnaissance and Grazing Working Plans*

1. Object, data to be obtained, collection of data, and compilations. 2. Analysis of data, leading to the formulation of a definite working plan. (Four credit units.)

1. Since the object of range reconnaissance is to secure all fundamental data necessary for the judicious management of the range, reconnaissance affords an exceptional opportunity for the student to become familiar with the general field of range management. The value of reconnaissance—the taking of an inventory of its forage assets and liabilities—and the application of the data to the management of the lands as a whole should be accentuated.

While a thoroughgoing course in grazing reconnaissance presupposes considerable field study in map-making, typing, estimating carrying capacity, etc., there are certain fundamentals that should be discussed in the class-room preliminary to the field-work. The data to be obtained, the necessity of a reliable topographic map, the importance of

the location of such features as water-courses, watering places, roads, trails, etc., familiarity with the forage (type) classification, how to collect the various data, the organization of the field party, etc., should be taken up in advance of the field study. In the field the student should do every important phase of the work, from the recording of all the more important data (including the collecting of plant specimens and the preparation of economic notes according to standard methods) to the transfer of the data on the township sheets.

2. The study following the field-work should begin with the assembling of the township maps into the major grazing units, provided, of course, that the mapping has been sufficiently extensive to justify such classification.[10] This should be followed by computations of the surface and forage acres for the various types, the determination of the class and number of stock to be grazed, the location of allotment lines, season of grazing, and other matters pertinent to the management of the range and the range stock. This work, in addition to the preparation of a written report covering matters that cannot be shown on the map, should aim to correspond with the finished reconnaissance and grazing working plan for a Forest, and should cover both intensive and extensive reconnaissance methods.

VI. *Grazing and Forest Protection*

> 1. Grazing in relation to timber reproduction, to fires, and to the efficiency of watersheds. 2. Grazing and recreational parks and the preservation of game animals. 3. Protection of live stock and the forage crop from insects and disease. (One credit unit.)

In schools where a course in "forest protection," or possibly where some special course closely allied thereto, is given, a discussion of the foregoing might be made a part of the established course. One lecture per week through the semester, supplemented by considerable side reading, should suffice to cover the subjct.

1. Grazing in relation to timber reproduction is a subject of such vital importance, both to silviculture and to grazing, as to justify very careful consideration. The discussion should cover particularly the relation of the damage inflicted to the reproduction of different species by the different classes of stock in the various regions, the damage according to season and intensity of grazing, the recuperative power of reproduction from varying degrees of injury, composition and abundance of the forage, age of the timber reproduction, and the management of the stock.

[10] Since only a relatively small area could be mapped by the students, provision should be made for the study of type maps of some Forest upon which the major range unit and allotment boundaries are not included.

The period of exclusion or rotation of grazing on forest plantations and on areas that are reproducing naturally should be taken up in detail.

The regular course on fire protection should include a discussion on the burning of grass and brush areas with a view to improving them for grazing. The character and accessibility of the forage growth subsequent to burning, the frequency of burning necessary for the improvement of the forage and the ultimate effect of such practice on the fertility of the soil and on the types of vegetation which the lands will support should be indicated; also the beneficial effects of grazing on forested lands, in the way of holding forest fires in check through the consumption of much inflammable material, should be recognized.

Grazing in relation to the efficiency of watersheds should embrace a discussion of the malpractice of excessive stocking and its effect on soil fertility, especially as a result of erratic run-off resulting therefrom; the difficulty of revegetation following the removal of the surface soil layer, as well as through heavy packing of the soil; and recognized preventive and remedial measures. Special attention should be directed toward the relative fertility and water-holding capacity of the normal rich surface layer of soil as compared with the deeper soil strata. Laboratory experiments to cover this phase cannot be too strongly emphasized.

2. The general policy of the Forest Service concerning the protection of game and the establishment of game preserves should be reviewed. The policy adopted on forests where the demand for range exceeds the supply and the welfare of the community is largely dependent upon live-stock production, and the policy concerning the establishment of recreational parks and game preserves should be especially considered. The favorable attitude of the Forest Service toward the establishment of recreational parks and toward the protection of game animals where a large proportion of the people of the community may derive benefit therefrom should be indicated.

3. The protection of live stock and, indeed, of the forage crop from serious attacks by insects and disease is often quite as important as is protection of stock from predatory animals or the forest from fires. The previous fundamental training in zoölogy should make it possible for the student to comprehend fully the seriousness of the ravages by the various pests and the methods of management designed to control the losses. As stated elsewhere, special courses in applied entomology and veterinary science should be arranged to cover the more important problems.

VII. *Range Finance*

1. Importance of accounting to efficient management of range and preparation of accounts in determining profits. 2. Cost of production of the various classes of live stock in the different regions. 3. Purchasing or renting ranch property. (Three credit units.)

1. It should be impressed upon the mind of the student that the adoption of strict business methods is quite as essential to successful live-stock production as to other lines of business. The particular accounts to be recorded and convenient methods of recording them should be emphasized. The records should include (1) the value of the lands used for grazing and for the growing of supplemental feeds, as well as the value of the live stock, feed, machinery, and other equipment on hand at the beginning of the year; (2) the total operating expenses and total receipts for the year; and (3) the value of the lands, live stock, feeds, machinery, etc., at the end of the year. Methods of recording the data (avoiding complicated systems of bookkeeping) and of making annual inventories should be carefully considered.

2. The cost of producing (1) cattle, (2) horses, (3) sheep, and (4) goats should be considered for the major stock-producing regions, such as the Southwest, the Northwest, the Middle West, etc., where the general plan of operation and the length of the winter feeding season within the respective regions are similar. The causes which contribute to the difference in the cost of production in the various regions should be fully discussed.

3. For those who desire to go into the stock-raising business, the matter of deciding on the locality, the size and type of the ranch in which to invest, and the class, and, indeed, the particular breed of stock to raise, are often perplexing problems. These questions, of course, must be decided very largely on an economic basis.

The capital available, the amount of money that must be invested in range and farm land, the length of the grazing season and of the winter feeding periods, distance from market, the element of risk, such as abnormal live-stock losses due to drought, poison plants, predatory animals—in short, the actual cost of live-stock production—are among the more important factors to be considered.

With limited capital, the taking of stock on shares or on a rental basis is often more profitable and usually involves considerably less risk than does investment in a ranch and live stock where it is possible to make a cash payment of only a small amount of the principal. The basic principles covering the economics of rentals and purchase of lands should, therefore, be taken up in detail.

NUMBER OF GRAZING SCHOOLS AND THEIR ORGANIZATION

While at present the possibilities of the application of range management are very great everywhere in this country and the subject is quite popular, it is the writer's belief that it would be a grave mistake at this time to initiate grazing courses in all of the forest schools or in a large number of our leading universities. There are two chief reasons for this belief: First, the fact that there is not yet available textbooks which adequately cover the subject, and hence the necessity of creating high-salaried positions to be filled by highly specialized men, and, second, the fact that the need for specially trained men will be overlooked by some of the smaller schools, the result being that many a so-called range technician will be graduated who will not be properly trained in the fundamentals and who, therefore, may be only moderately successful in his work. As the initial step, it would be well to establish a chair in grazing in four or five of our leading schools—two, possibly, in the East, one in the Middle West, and two in the Far West.

Since the professional forester as well as the range technician is more or less intimately associated with the management both of the timber and the forage resources, and hence should have training both in forestry and in grazing, it seems logical, in the beginning at least, that the study of range managemest should be handled as a branch of the forest school. To be sure, the grazing work could be co-ordinated with the Department of Botany, or, indeed, with Agronomy; but the much-desired co-operation with the school of forestry would probably be most fully enjoyed if the work were handled there.

COURSES NECESSARY TO THE TECHNICAL FORESTER AND RANGE TECHNICIAN

While all of the subjects here suggested bear more or less directly on the administration of all Forests and other timbered lands where live stock is handled, some are particularly pertinent to the training of what is usually termed the "professional" forester. Probably the most important are those grouped under the following: III—Management of the Range; IV—Management of Range Live Stock, and VI—Grazing and Forest Protection. Some training in II—The Important Native Range and Pasture Plants, and in V—Range Reconnaissance and Grazing Working Plans—is also important. Some understanding of these subjects, however, would be had where the field training in timber reconnaissance is co-ordinated with that of grazing reconnaissance, as would no doubt prove expedient.

Those who specialize in grazing and are preparing to enter the U. S. Forest Service should not fail to avail themselves of the opportunity of taking certain forestry courses. Probably the most pertinent of these subjects are: Silvics, silviculture, forest utilization, and forest protection. Certainly silviculture is a subject with which nearly every range man in the Forest Service is concerned. It enters into the grazing problems on cut-over lands, on burns, on plantations, and, in fact, wherever both forestry and grazing are practiced.

THE TYPE OF MAN

Little less important than the high standard of training proposed for the technical grazing man is the class of men those who undertake to teach the subject will encourage to pursue this study. The student who has had practical experience in diversified farming or ranching and who has had the good fortune of handling the different classes of stock, even on a very small scale, has so distinct an advantage over the city-reared chap, with no farm or ranch experience, as to make it quite difficult for the latter to compete successfully with the former until he has himself had considerable work in this field. In other words, it costs infinitely more to develop to a high point of usefulness the average city-bred man, whose sole asset is his college training in grazing, than it does the average man with a few years of farm experience who is similarly trained. What success the writer may have had in the development of principles applicable to range administration on National Forests, for example, is probably as much due to his experience in diversified farming as to his training in the sciences.

To have practical application, any research problem in grazing must be based not only upon the fundamental laws of botany and other sciences, but upon a practical knowledge of the broad field of the live-stock industry as well. That the man who has had practical experience in live-stock production and who is trained in the sciences, as outlined in this paper, should succeed in shaping his investigations and grazing policies to meet the present and future requirements infinitely better than either the purely "college-made" range technician or the practical range man, requires no argument. The teacher of grazing, therefore, should use fully as much discretion in encouraging students to specialize in this group as those who teach medicine, law, or technical forestry. Obviously, this discussion presupposes that men of much dynamic force, strong personality, keenness of mind, and numerous other qualifications are of inestimable importance.

In conclusion, the writer wishes again to emphasize the importance of fundamental training. As the old saying goes, "A little knowledge is dangerous." It is liable, among other things, to cause serious blunders and the creation of short-sighted policies. With the right balance in foundational training and with well-balanced technical courses, the range technician as well as the technical forester should prove his worth both in public and private work.

A FOREST RECONNAISSANCE OF THE DELAWARE PENINSULA

By Roland M. Harper

The Delaware peninsula, including most of Delaware, about one-third of Maryland, and two counties of Virginia, about 5,700 square miles in all, is a part of the coastal plain characterized by rather monotonous topography (scarcely exceeding 100 feet above sea-level at any point), but considerable diversity of soil, with corresponding differences in vegetation and economic features. The northern boundary for the purposes of this paper may be placed at the Pennsylvania Railroad from Wilmington to Elkton and the Elk River from Elkton southwestward, thus excluding Elk Neck, which differs from the larger peninsula in many ways. The northern part of the peninsula does not differ very much from the corresponding parts of New Jersey and Maryland, northeast of Delaware Bay and southwest of Chesapeake Bay, but from there toward the extremity of the peninsula the conditions become more and more unique, and we find nothing corresponding either to the pine-barrens of New Jersey[1] on the one hand or the hills of Southern Maryland[2] on the other.

Generally speaking, the richest soils on the peninsula are nearest the fall-line and the poorest near the coast, but the gradation is not uniform, but rather by steps; and the area can be conveniently divided into six essentially distinct regions by lines approximately parallel to the fall-line, as shown on the accompanying map. Most of these lines have been located along the boundaries of certain Cretaceous and Tertiary formations, a choice which seems to give the maximum contrast between adjacent regions. Geologists have also subdivided this part of the coastal plain in another way, according to its supposed Pleistocene history, calling most of the area below 50 feet the Talbot terrace and the inner and higher parts of the peninsula the Wicomico terrace.[3] But it is difficult to make any satisfactory correlations of general application between these alleged terraces and the soils, vegetation, or any other geograph-

[1] For a recent description of the forests of the New Jersey pine-barrens, see Bull. Geog. Soc. Phila., *16*: 118-121. Dec., 1918.

[2] See Jour. Wash. Acad. Sci., *8*: 586-587. Nov., 1918.

[3] See Md. Geol. Surv. Report on Pliocene and Pleistocene, by G. B. Shattuck, 1906.

ical features, and they may very well be disregarded for the present.[4] A preliminary study of the forests and other conspicuous vegetation of this peninsula, based on previous literature and about six hours of note-taking from the car window on July 18, 1908, was published in Torreya (9:217-226) for November, 1909. Since that time have appeared Shreve's Plant Life of Maryland (1910)[5] and Besley's report on the forests of Maryland (1917),[6] which give many additional details about the Maryland portion. Besley's report shows the location and approximate composition and density of every forest area in Maryland large enough to be mapped on the scale used, and although it does not attempt to give the percentage of any one species, the figures for pines and hardwoods have been very helpful in checking up the writer's evergreen percentages.

In June, 1917, and September and November, 1918, the writer spent a few days on the Delaware peninsula, visiting every region and every county not previously traversed, and taking as full notes as possible on the vegetation, especially the trees. The results are here brought together as a preliminary forest census of the area, not only as a contribution to our knowledge of the forest resources of the United States, but also to bring out some significant relations between soil and vegetation in an area where differences of topography and climate are practically eliminated, and to illustrate a method of tabulating forest resources where the field-work has not been sufficiently thorough to warrant one in assigning precentages to each species. The regions will first be described briefly, with special reference to the prevailing soil types and tree species, and then the method of tabulation explained and illustrated. No chemical analyses of Delaware peninsula soils have come to the writer's notice, but parts of each region, except the southernmost, have been mapped at various times by the U. S. Bureau of Soils, and from the reports of that organization one can compute the approximate percentage of each soil texture class (*e. g.*, sandy loam, silt loam, clay) in each region, which gives some idea of the fertility, for the soils of finest texture are usually the best.[7] The percentages are not given here, because some of the regions were surveyed too long ago for accurate results and others are not yet adequately covered, but the principal soil

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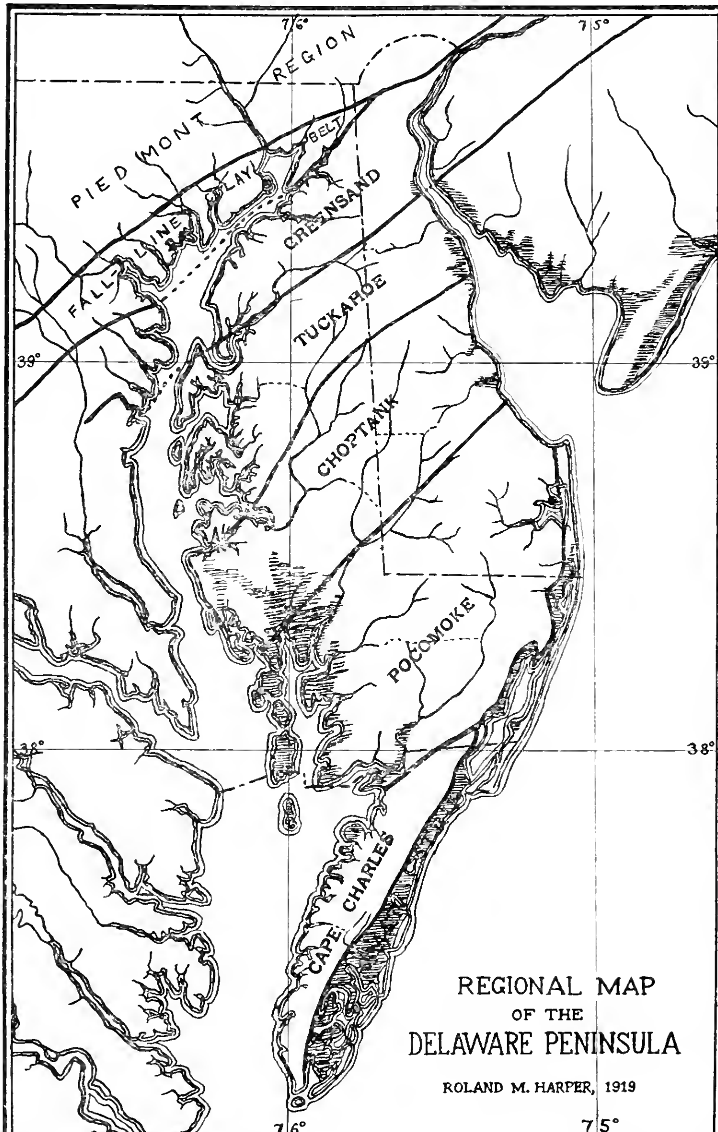
[4] Dr. Shreve in the Plant Life of Maryland, 1910 (pp. 109-124), attempted some correlations between these terraces and the vegetation without recognizing the geological belts here described, but it is evident from his own statements (*e. g.*, p. 118), as well as from the most cursory observation, that there is more difference in vegetation between the northern and southern parts of the same terraces than between neighboring parts of different terraces.

[5] Reviewed in Torreya, *11*: 36-42. 1911.

[6] Reviewed in Torreya, *18*: 120-122. 1918.

[7] For an explanation of the method used, see Soil Science, *4*: 91-95. 1917.

types are listed in order of area in the regional descriptions. The trees are likewise listed in order of abundance, but making a distinction between those that usually reach merchantable size and small trees like the dogwood and holly.



Map showing location of the forest regions described herein and two or three neighboring ones, on a scale of 1 to 2,000,000. The parallelism of the several regions, and the different kinds of coast line on the Chesapeake Bay side are noteworthy.

Besides the differences in soils and area and composition of the forests here pointed out, these regions differ notably in the shape of their shorelines (see map), in density, racial composition, and rate of increase of population, in size of farms, proportion of pasture and plowed ground, value of farm buildings, relative importance of different crops and farm animals, and in several other features covered by census data; but these matters can be discussed more appropriately elsewhere.

REGIONAL DESCRIPTIONS

1. The greensand belt, which extends nearly all the way from New York to Washington, a little below the fall-line, has an area of about 600 square miles on the Delaware peninsula, where it is practically coextensive with the area mapped by geologists as Cretaceous and Eocene.[8] Its coastward edge passes approximately through Townsend, Del., Chestertown and Love Point, Md. The underlying formations contain considerable greensand marl, which does not show much at the surface, but nevertheless influences the soil enough to make it considerably above the average in fertility. The prevailing soil texture classes are silt loam, loam, marsh, gravelly loam, sandy loam, and meadow.

Only about 15 per cent of the area is now wooded, and the average stand of merchantable timber is about 1,580 feet per acre, according to Besley's figures for the Maryland portion. The scarcity of timber is reflected in the absence of rail fences and the use of corn-stalks for shed roofs on many of the farms. Probably not more than 5 per cent of the trees are evergreen, which is a good indication of the fertility of the soil. The commonest trees at the present time seem to be sweet-gum, poplar, white oak, chestnut, red maple, beech, black-gum, hickory, willow oak, pin oak, swamp chestnut oak, and scrub pine, and the commonest small trees willow and dogwood.

2. What may be called provisionally the Tuckahoe region (from one of its streams) corresponds with that part of the peninsula underlaid by the Calvert formation of Miocene age, and has an area about 1,000 square miles. Like the next three regions, it has no close counterpart elsewhere, though in vegetation alone it does not differ very much from some other parts of the coastal plain. Its southeastern boundary is rather indefinite, but passes through or near Dover and Easton. The soils are almost as fertile as those in the greensand belt, and the prevailing texture classes are sandy loam, silt loam, loam, marsh, loamy sand, meadow, and fine sandy loam.

[8] For descriptions of the forests of the New Jersey and Southern Maryland portions of the same belt, see Bull. Geog. Soc. Phila., *16*: 117-118; Jour. Wash. Acad. Sci., *8*: 584-586. 1918.

Something like 2 per cent of the area is tidal marsh, and the forests have been reduced by civilization to less than 30 per cent of their original extent. The average stand of timber is 2,800 feet per acre, according to Besley's figures, and about 30 per cent of the trees are evergreen. The commonest trees seem to be sweet-gum, loblolly pine,[9] white oak, red maple, poplar, willow oak, chestnut, beech, black-gum, scrub pine, and black oak, and the small trees willow, dogwood, and bay.[10] Old rail fences are rather common, indicating the former presence of chestnut in considerable quantities. (At present most of the trees of that species are more or less blighted, as is usual within a few hundred miles of New York City since 1906.)[11]

3. The Choptank region, covering about 1,400 square miles on both sides of the river of the same name, corresponds with the area of the Choptank and St. Mary's formations on the peninsula, as indicated on the 1906 geological map of Maryland. Its coastward boundary, where the Miocene strata are supposed to dip beneath sea-level, corresponds approximately with the Nanticoke River. The region is rather low and flat, with considerable marsh along both bays, and some of the rivers on the Chesapeake side are navigable for steamers about half way across the peninsula. The soils are moderately fertile, and the prevailing texture classes (in Caroline and Talbot Counties at least) are sandy loam, silt loam, loamy sand, sand, loam, marsh, and meadow. (If Dorchester County had been mapped by the Bureau of Soils, marsh would stand higher, for according to Besley that county is 21 per cent marsh.)

About 8 per cent of the area is salt marsh, 35 per cent forest, and half fields and pastures. The average stand of timber in Caroline and Dorchester Counties, according to Besley, is 2,435 feet per acre, and about 55 per cent of the trees are evergreen. The commonest large trees are about as follows: loblolly pine, scrub pine, red maple, sweet-gum, white oak, poplar, willow oak, black-gum, and red oak.[12] Among the small trees bay, dogwood, holly, and willow prevail.

4. The Pocomoke region (named for its principal stream) is nearly coextensive with that part of Maryland and Delaware in which only Pleistocene strata appear above sea-level. There is no known geological

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[9] *I. e., Pinus Tæda.* I have no evidence that the name "loblolly pine" is actually used on the Delaware peninsula, but that is the name most frequently used for this species in the literature of forestry.

[10] *Magnolia glauca.*

[11] See map of the chestnut blight area by Metcalf and Collins in Science, II, 35: 420, 1912, and comment on the same on page 985 of the same volume.

[12] *I. e., Quercus falcata* (formerly *digitata*), which is called red oak throughout the South, and not *Q. borealis maxima,* which is called red oak in most of our books, that being a translation of its former technical name (*Q. rubra*). In this connection see Ashe, Proc. Soc. Am. Foresters, *11*: 233-235. 1916.

boundary to mark its southern edge, but that may be placed for convenience at or about the Maryland-Virginia line, where the peninsula abruptly becomes too narrow to have any rivers on it. The area is about 2,000 square miles. The rivers remind one very much of some in Florida, being sluggish, with coffee-colored water, navigable most of their length, and bordered by swamps containing cypress and a few other trees characteristic of warm-temperate regions. The soils are rather below the average in fertility, and the prevailing texture classes, as mapped in Worcester County about 15 years ago (with corrections to 1913 from Bulletin 96 of the Bureau of Soils), are sand, sandy loam, silt loam, swamp, and marsh. (Somerset County, whose soils have not yet been mapped, is 16 per cent marsh, according to Besley.)

Forests still cover nearly half the area, and there is considerable virgin growth, especially in the swamps. Besley's figures put the average stand of timber at only 1,823 feet per acre, which is probably explained by the fact that the lumber industry is more active here than in any other part of the peninsula, so that the trees do not have much chance to grow large. Something like 65 per cent of the forest is evergreen. The commonest trees seem to be loblolly pine, sweet-gum, white oak, willow oak, red maple, water oak, scrub pine, red oak, black-gum, black oak, short-leaf pine, cypress, and poplar, and the small trees holly,[13] bay, and dogwood. Nearly all the cypress shown on Besley's forest maps of Maryland counties is in this region, along the Pocomoke River and its tributaries, and the white cedar has a somewhat similar distribution in this latitude. There are quite a number of shrubs and herbs here that are not known elsewhere between the pine-barrens of New Jersey and North Carolina, and the writer recently added to the list of pine-barren trees *Pinus serotina*—or something closely akin to it—growing in several sandy bogs a few miles southwest of Snow Hill.

5. What may be called the Cape Charles region includes the mainland of the two Eastern Shore counties of Virginia, about 500 square miles. There is little information to be had about the geology except that it is all quite recent, and no maps of the topography, soils, or forests are available yet. The topography is rather flat, but not swampy, and most of the surface seems to be 20 to 50 feet above sea-level. There are no rivers, and consequently trees characteristic of swamps and alluvial soils are rare or absent. The soils seem to be mostly sandy loams and fine sandy loams, and although they are below the average in fertility, they respond readily to fertilization, and its climate and accessi-

[13] Some of the holly in this region and the next is large enough for saw timber, but its average size places it among the small trees.

bility to northern markets have made this one of the most important truck-farming regions along the Atlantic coast. Irish and sweet potatoes are the most important crops, and the rural population is remarkably dense—nearly 100 per square mile—and apparently quite prosperous.

Over half the area appears to be wooded at the present time, but probably half the existing forest is second growth, on land formerly cultivated but abandoned on account of exhaustion before the days of commercial fertilizers. The boundary between forests and fields is pretty sharp now, though, presumably indicating that very little farm land has been abandoned in recent years. Fences are scarce, partly because the fields are not, as a rule, pastured in rotation like those in the northern half of the peninsula, and probably also on account of the scarcity of suitable timber for rails or posts. The commonest trees seem to be loblolly pine, scrub pine, sweet-gum, white oak, red maple, red oak, water oak, willow oak, black oak, black-gum, and hickory, and the small trees holly, dogwood, and bay. About 80 per cent of the trees are evergreen. Small sawmills are common, mostly making barrels and boxes to ship potatoes and vegetables in.

6. The coast strip includes the sandy beaches, islands, and salt marshes along the Atlantic coast from Cape Henlopen to Smith's Island, an area of only 100 square miles or so. The marshes and narrower beaches are treeless, but there are forests on the inner side of the beach strips where they have a width of half a mile or more, and also on the inner islands, such as Chincoteague.[14] On account of the prevailing sandiness of the soil the amount of forest cleared away by farmers is insignificant, perhaps not over 1 per cent of the total.

In the Maryland and Virginia portions of the coast strip loblolly pine constitutes about nine-tenths of the forest, but toward Cape Henlopen the pitch pine, which is rare elsewhere on the peninsula (but very abundant in New Jersey), predominates. Next in order are sweet-gum, water oak, red oak, post oak, and red maple. Holly is the only small tree that is at all common.

FOREST CENSUS

The following table, indicating the approximate relative abundance of the trees in each region, except for adjusting the evergreen percentages

[14] The works of Rusby (Bull. Torrey Bot. Club, Aug., 1891) and Sterrett (Del. Exp. Sta. Bull. 82), cited in my 1909 paper, give some idea of the plant growth of this part of the coast, and more detailed descriptions of the vegetation in the neighborhood of Cape Henlopen can be found in two illustrated papers by Miss Laetitia M. Snow in the Botanical Gazette for October, 1902, and January, 1913. See also, J. T. Rothrock, Forest Leaves, *2*: 83-85. 1889.

a little in accordance with Besley's Maryland estimates, is based solely on the writer's field-work on 13 different days, comprising about 530 miles of travel by rail in 20 hours and 140 miles of walking in 58 hours, or about a minute for each square mile of forest, on the average. How accurate or inaccurate the results are can be seen after the forests of the same area have been analyzed by counting the trees on numerous selected areas, in the manner usually employed by foresters, provided this is done before much more change takes place.

The results being hardly accurate enough yet to warrant assigning percentages to each species in each region, a system of easily remembered letters for groups of percentages is used instead. The leters are not only easy to remember on account of the words they stand for, but their alphabetical order corresponds with the degree of abundance they indicate. All percentages over 20 are given in figures, those from 10 to 20 indicated by A (abundant), from 3 to 10 by C (common), from 1 to 3 by F (frequent), from 0.1 to 1 by O (occasional), from .01 to 0.1 by R (rare), and those less than .01 by S (scarce). If desired, one might go still farther and have V for very scarce, X for exceedingly or extremely scarce, etc. It is not proposed that these letters should always be used hereafter for exactly the same percentages, but the scheme is merely put forward as a suggestion, with the hope that it may be tried elsewhere and improved upon.[15]

Where the occurrence of a given species in a given region is doubtful, an interrogation point is used, and where it is believed to be entirely absent the space is left blank. Species that do not rank above rare in any region are omitted entirely, to save space. Where a species is believed to be more abundant in one region than in any of the others, its letter in that column is printed in heavier type. (This was done with the figures in my forest census of Alabama[16] about three years ago, and is even more important in the case of letters, for percentages as far apart as 11 and 19 are indicated by the same letter.) Only trees that ordinarily reach merchantable size (say a foot in diameter) are listed in the table, for the percentages are intended to be based on volume, and it is difficult to compare the relative abundance of trees differing greatly in size in hasty reconnaissance work where no counts or measurements are made. But if it seemed desirable, one could easily put the small trees in the same table and use small letters for them.[17]

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[15] See discussion of a somewhat similar terminology for birds by J. D. Kuser and others in Science for June 14, Aug. 2 and 30, 1912.

[16] Proc. Soc. Am. Foresters, *11*: 208-214. 1916.

[17] For a method of treating trees of different sizes quantitatively in reconnaissance work, see 6th Ann. Rep. Fla. Geol. Surv. (1914), p. 178.

Regions.	1. Green-sand.	2. Tuck-ahoe.	3. Chop-tank.	4. Poco-moke.	5. Cape Charles.	6. Coast strip.	Whole penin-sula.
Percentage of forest	15	27	35	48	60	?	40
Percentage of evergreens	4	30	55	65	80	95	62
Expenditure for fertilizers, 1909-10	1.10	.88	1.18	1.34	7.63	?	1.61
Trees.							
Pinus Tæda (loblolly pine)	?	21	32	52	63	86	48.0
Pinus rigida (pitch pine)	.....	.....	O	F	.....	C	1.0
Pinus echinata (short-leaf pine)	.....	.....	.....	F	F	.....	1.3
Pinus Virginiana (scrub pine)	C	C	23	C	A	?	10.5
Taxodium distichum (cypress)	.....	.....	.....	F	.....	.....	0.5
Chamæcyparis thyoides (white cedar)	.....	.....	O	O	.....	.....	0.2
Hicoria alba (hickory)	C	F	F	O	O	.....	1.0
Juglans nigra (black walnut)	O	.....	.....	.....	.....	.....	0
Betula nigra (birch)	F	F	O	O	.....	.....	0.3
Fagus grandifolia (beech)	C	C	O	O	O	.....	1.3
Castanea dentata (chestnut)	C	C	F	O	R	.....	1.4
Quercus alba (white oak)	A	C	C	C	F	?	5.0
Quercus stellata (post oak)	O	O	O	O	O	F	0.9
Quercus Michauxii (swamp chestnut oak)	F	F	O	O	O	.....	0.8
Quercus montana (chestnut oak)	F	.....	.....	.....	.....	.....	0.1
Quercus velutina (black oak)	?	F	F	F	F	.....	1.5
Quercus falcata (red oak)	F	F	F	F	F	F	2.4
Quercus coccinea (Spanish oak)	O	?	?	O	O	.....	0.3
Quercus Marylandica (black-jack oak)	.....	.....	O	O	.....	?	0.1
Quercus palustris (pin oak)	C	F	O	R	.....	.....	0.4
Quercus nigra (water oak)	.....	.....	F	C	F	F	2.3
Quercus Phellos (willow oak)	C	C	C	C	F	O	3.6
Ulmus Americana (elm)	?	F	.....	.....	.....	.....	0.2
Morus rubra (mulberry)	F	?	O	.....	.....	.....	0.1
Liriodendron Tulipifera (poplar)	A	C	C	F	O	.....	2.4
Liquidambar Styraciflua (sweet gum)	A	A	C	C	C	C	6.9
Platanus occidentalis (sycamore)	O	O	.....	.....	?	.....	0.1
Acer rubrum (red maple)	C	C	C	C	F	F	4.6
Nyssa sylvatica (black gum)	C	C	C	F	F	O	2.7
Fraxinus Americana (ash)	O	O	O	.....	.....	.....	0.1

The percentages for the peninsula as a whole, being made up from the returns for six regions, have only about one-sixth the liability to error of those in any one region, and can be given with more confidence; and they are given in figures to the nearest tenth in the last column. (This suggests a method of making a rapid inventory of the forests of a single state, in which most persons will wish to know only the state percentages and the region where each species is most abundant.)

At the head of the table, to facilitate comparison, are put the figures already given in the regional descriptions for the percentage of forest remaining and for evergreens, and also the average amount spent for fertilizers in 1909 per acre of improved land in 1910, this last being a rough measure of the fertility of the soil.

The figures for forest area, evergreens and fertilizers all indicate a progressive and fairly regular decrease in soil fertility in going from the fall-line toward the coast.[18] The relative abundance of many of the trees shows a corresponding gradation. For example, *Pinus Tæda*, the most abundant of all, increases decidedly in abundance toward the coast, though climate is doubtless a factor here, too, for the northern part of the peninsula is almost too cold for it. *Hicoria alba, Juglans, Betula, Fagus, Castanea, Quercus Michauxii, Q. palustris, Morus, Liriododendron, Liquidambar,* and *Nyssa*, all decrease coastward, presumably on account of soil conditions, for most of them are also perfectly at home in the richer parts of Florida. Still another group of species, including *Pinus rigida, P. echinata, Taxodium, Chamæcyparis,* and *Quercus nigra*, with *Magnolia glauca* among the small trees, are most abundant near the center of the peninsula, while several others seem from the available evidence to have an anomalous distribution. Some of the last category, however, will doubtless be found on more thorough exploration to belong in one of the groups just indicated.

[18] It should not be inferred from this, however, that a similar gradation is characteristic of the whole coastal plain. Farther south the coastal plain is more diversified, and cannot be divided so regularly into parallel belts as on this peninsula.

REVIEWS

State of Montana, Fifth Biennial Report of the State Forester, 1917-18. Helena. 1918. Pp. 99.

This report is notable chiefly because of the inclusion of an unusually comprehensive and far-sighted contribution from J. F. Preston, Assistant District Forester, U. S. Forest Service, entitled "Economic Use of the Forests of Montana." The report proper, however, also contains much interesting information. We learn from it, for example, that during the fiscal year ending November 30, 1918, the 326,000 acres of State forests in Montana yielded a return of over $30,000. This was sufficient not only to pay the expenses of the State Forester's office, but to leave a net return of more than $11,000. In other words, the State forests are on a sound footing financially and much more than pay for themselves. In addition to these receipts, the counties received over $76,000 from the National Forest "Reserves" for the fiscal year ending June 30, 1918. The commercial value of the forests of the State under all ownerships is estimated at approximately $1,400,000,000. The total stand is estimated at 58 billion board feet, 29 per cent of which is privately owned, 4 per cent is owned by the State, and the remaining 67 per cent is owned by the Federal Government. Over 70 per cent of the annual cut, however, comes at present from private lands.

The greater part of the State Forester's report, as is usual in such reports, is devoted to fire protection. The needs of the State in this respect are outlined at considerable length, and a draft is submitted of a proposed law to prevent burning during the dry season—from June 1 to September 30—except under permit. In the absence of such legislation at present, the Montana Council of Defense, in June, 1918, issued an order along these lines effective for the duration of the war.

Among the miscellaneous topics discussed are the white-pine blister rust, the "red-belt" injury, farm and city trees, qualities and uses of the more important Montana woods, and the proposed timber-land exchange with the Federal Government.

Several specific recommendations of a progressive character are made by the State Forester, as follows:

(*a*) The enactment of a forest-fire law preventing burning during the period from June 1 to September 30, except under permit.

(*b*) The amendment of the present State forestry laws, which now forbid the sale of timber less than 8 inches in diameter at a height of 20 feet from the ground, so as to permit the sale of lodgepole pine of smaller size which should be cut for the good of the forests and to reduce the fire menace.

(*c*) The enactment of a law authorizing the State Forester to sell without advertising live timber not exceeding $500 in value.

(*d*) The enactment of a law requiring the disposal by burning or otherwise of the brush, slash, and other inflammable material incident to cutting on all lands within the State of Montana, whether public or private.

(*e*) The erection of a forestry building at the State fair grounds, to be used for the permanent exhibition of material relating to Montana's forest resources.

(*f*) The authorization of the Forestry Department by the State Board of Land Commissioners to use airplanes in forest-fire patrol. The State Forester estimates that one machine will equal the services of 60 men.

The remarkable feature of Mr. Preston's paper, as part of a State Forester's report, is that it actually discusses in a comprehensive way some of the fundamentals of forestry. In place of glittering generalities regarding the need for forest conservation, of botanical descriptions of forest trees, and of hackneyed arguments for fire protection, it is a relief to find in a report of this kind a plea for handling the forests on a sustained-yield basis, backed up by facts and figures and accompanied by definite recommendations for State action.

The underlying theme of Mr. Preston's paper is expressed in his own words, as follows:

"We have the choice now of saying whether we want a permanent forest industry or only sawdust piles and waste land to remind us of past prosperity. . . . Thirty per cent (which includes the best timber) of the forest resources are in the hands of private owners. The control and proper use of this land and timber are entirely matters for the State to undertake. It means not only some degree of control, but active assistance to the industry which manufacures finished products from the forests. The purpose of this report is to show the extent and value of the forests of the State, the lumber industry which they support, the wealth created, and the people dependent on it for a livelihood, the present and future needs of the people of the State for forest products, and, lastly and most important, to point out some of the things the State must do to develop and make permanent the wealth and industry which come from well-regulated forests. We must not wait until our forests are depleted with axe and fire before taking steps to insure the permanency of the forest industry. Montana should take steps now to strengthen the State forestry organization so that it will be able not only to look

after the State lands and forests, but to point the way, step by step, to a forest policy which will insure Montana's place as a progressive, prosperous, and wholly productive State."

The basis for such a forest policy is found in a mass of detailed statistics presented by Mr. Preston regarding the forest resources of the State and their present and possible future utilization. While these will well repay study, specific reference can be made here only to a few of the more important figures bearing directly on Mr. Preston's arguments for immediate action to bring about the practice of forestry.

Under present conditions, it is estimated that 900 million board feet could be removed from the forests of Montana each year without injuring either their permanence or the continuity of the cut. Through the increased growth possible as the present primeval forests are removed and their place taken by growing stands of young timber, it is estimated that this cut could in time be increased to 2,250 million feet. With the present annual utilization within the State of some 385 million feet of lumber and 595 million feet of forest products of all kinds, it is evident that the forest resources of the State, if properly handled, are sufficient not only to meet its own needs indefinitely, but to leave a large surplus for export elsewhere. This is particularly true, in view of the fact that the present annual per capita consumption of forest products is about 1,600 board feet, which is considerably higher than the average for the country as a whole, and may be expected to decrease as the State becomes more settled. Even the present cut, however, cannot be continued indefinitely, to say nothing of an increase, unless the forest lands of the State are kept productive.

At present only about 52 per cent of the lumber consumed in Montana is produced in the State, practically all of the rest coming from Idaho and the Pacific Coast. Allowing for a certain amount of large, high-grade material which the State would probably have to continue to import, Mr. Preston points out that if Montana were to supply only 75 per cent of its total requirements, certainly a conservative estimate, the saving in freight would amount to a total reduction in the price of lumber now paid by the consumer of $380,000 annually. He leaves to the reader the calculation of the increased price which would have to be paid by the consumer should the importation of much larger quantities be necessitated by failure on the part of the State to perpetuate its own forest resources.

As evidence of the economic importance of the lumber industry, Mr. Preston estimates that the investment in the industry (including stumpage, transportation facilities, retail yards, stocks on hand, etc.) is $78,-

000,000; that it employs some 12,000 workers, and that it involves an annual expenditure of $20,800,000, or sufficient to support more than 14 per cent of the entire population of the State (on $1,200 per family per year!). The magnitude of the industry is also shown by various calculations as to the length of the imaginary train necessary to haul the forest products cut in Montana in 1916, the thousands of miles of sidewalk they would make, the number of modern 5-room cottages they would build, etc.

If one were inclined to be critical, he might hint that Mr. Preston tends to stretch a point occasionally in his effort to drive home what the forests really mean to the people of the State, as, for example, in including transportation wholly as a labor cost. But such slips are of minor importance, and the general picture that he presents is not only forceful, but undoubtedly true. One cannot help wishing, however, that he had expanded or explained his statement that "Any one familiar with logging and lumbering operations realizes that this is a very risky and hazardous business and is entitled to a higher margin, to insure a fair industrial return, than almost any other line of business." While this may be true under present conditions, it is only so because the principal factors that make the business hazardous, such as fire danger, labor difficulties, and over-production, are in large part caused by the unstable and speculative character of the industry itself. European experience has demonstrated amply that where the forests are managed on the basis of a sustained annual yield, their production and utilization forms one of the safest rather than one of the most hazardous of businesses. With the stabilization of conditions afforded by the practice of forestry, the large profit now demanded by the lumber industry would be unjustified, with a corresponding reduction in price to the consumer.

Mr. Preston's conclusions are of sufficient interest, to foresters as well as to others, to justify quoting at some length:

> "When we consider that the future expansion in the lumber industry will mean the support of two or three times this number of people (70,000), that the lands which support timber must (except for a very small percentage) continue to grow timber or become non-productive waste land, that the future of the business is entirely within our hands—to develop and conserve and stabilize or allow to expand and grow disproportionately as a mushroom, leaving nothing for future generations—we begin to realize that the preservation and the right use of this resource is a matter of very great public concern. . . . What is needed is a strong Forestry Department of the State Government, which, through constant study of the problem, will be able to formulate a far-sighted forest policy and ask the support of the people and the legislature in carrying it out. . . . With the broad and far-reaching purposes of forestry in mind, I have attempted to indicate more specifically a few of the things the State should do in the immediate future.

"(*a*) Commit itself, like the National Government, to a policy calling for the highest use of all lands.

"(*b*) Classify the forest lands of the State and designate those of greatest value for permanent forest production regardless of ownership.

"(*c*) Adopt measures which assist private, State, and Federal owners to consolidate holdings so as to permit economical administration.

"(*d*) Exercise some control of private lands with reference particularly to:

"(1) Methods of cutting, so as to insure restocking of the land with trees;

"(2) Disposal of brush and debris left from logging to minimize the fire risk;

"(3) Distribution of cutting with reference to permanent industries;

"(4) Control of forest fires.

"(*e*) Co-operate with the National Forest Service in regulating the cut to the limits of forest productivity. To do this will mean:

"(1) Some control over the number, location, and size of sawmills;

"(2) Collection of data on rate of growth of timber, distribution of age classes, etc;

"(3) Silvicultural management of State forests;

"(4) Prevention of private owners from withholding ripe timber from the market when such policy interferes with development of local communities.

"(*f*) Adopt measures for educating and making good citizens of woods workers. This means co-ordinating industries to make possible year-long employment and establishment of homes.

"(*g*) Directly assist the lumber industry in:

"(1) Gathering statistics of lumber manufacture, shipments, and consumption;

"(2) Making a study of Montana markets and taking such action as may be possible to reduce the cost of lumber to consumer;

"(3) Educating the people to use Montana forest products by giving authentic information as to their uses and values compared to other woods;

"(4) Making a study of wood substitutes and compiling data concerning relative values;

"(5) Studying efficiency of methods of logging and milling in order to reduce costs;

"(6) Creating an organization capable of impartially appraising stumpage values and scaling logs when in dispute."

Surely a comprehensive and forward-looking program! Both the State Forester and Mr. Preston are to be congratulated on its publication for general distribution within the State. It is to be hoped that it may attract general attention and receive careful consideration not only in Montana, but in other States as well. One's only regret is that the State Forester did not take advantage of the opportunity to urge definite action by the State along the lines suggested by Mr. Preston.

S. T. D.

Waipoua Kauri Forest: Its Demarcation and Management. D. E. Hutchins, I. F. S., Department of Lands and Survey, New Zealand. 1918. 63 pp.

This very readable bulletin by Mr. Hutchins, formerly of the Cape Colony, and later of the British East African Forest Department, gives a good picture of the best Kauri forest in New Zealand. It is written with an appreciation of the scenic, as well as the commercial, value of the forest. The author says: "The Waipoua forest has to be thought of as a tourist resort. The old Kauri trees are one of the sights of New Zealand. When the railway is completed into and through the Kauri forest, that will be the place in the world to see Kauri trees. The Waipoua forest should be the tourists' spot of northern New Zealand, with a name in Australasia similar to the Black Forest in Europe. There is forest scenery at Waipoua which can be seen nowhere else on this globe." This is the largest and best of the Kauri forests left in the Dominion having a demarcated area of approximately 30,000 acres. Few American foresters realize the immense size attained by the Kauri. There were two gigantic Kauri in the Tutamoe State Forest, each having a diameter of 22 feet, and the best one having a clean bole of 100 feet. This was estimated to contain 295,788 board feet, which is twice the size of the largest California big tree, one of the Calaveras grove containing 141,000 board feet. Individual trees in Waipoua forest are valued as high as £200 ($1,000) apiece.

More abundant than the Kauri, but of comparatively insignificant size, is the Taraire. This tree runs about 2 feet in diameter and 25 to 40 feet bole. In the best of the Kauri zone about one-third of the forest is Taraire (New Zealand oak), a tree which promises in the future to have a high value. This and the Purire are reputed to be the fastest growing native trees in northern New Zealand. One specimen of the Taraire is said to have attained a diameter of 13 inches in 18 years. The timber has much the appearance of the English oak.

Above the Kauri forest, at an elevation of 1,000 to 1,700 feet, is a mixed forest type containing no Kauri, but with scattered specimens of Rimu, white pine, Miro, and Totara.

The average stand of millable timber per acre in the New Zealand forests is 15,000 board feet. The estimated stand of the Waipoua forest is 80 million board feet of Kauri and 200 million board feet of other species. At present values this forest of 30,000 acres has an average value of over $90 an acre.

Mr. Hutchins recommends a working plan for this and the other forests of New Zealand providing for: (1) working off the old stocks of

timber from the virgin forest with little delay; (2) starting the rejuvenated, improved cultivated forest as soon as possible; (3) providing for a fair distribution of age classes at the end of the rotation. The effect of this management would be that after cutting out the present stock of Kauri and other timber, the forest for about 100 years would give much the same average employment and average money returns as successful dairying on this soil. At the end of 100 years the average stand of timber would be about 10 times the present stand; and the forest revenue, reckoned at double present Kauri prices, would be about $50 per acre per year net in perpetuity. The high prices for timber and the extraordinarily high possible returns from good management are, of course, due to the scarcity of timber in that part of the world and the distance from the great forest regions of Siberia and America.

As compared to a probable net income of $50 an acre under good forest management, the dairy specialist estimates the present income from grazing the grasslands in this region at only about one-tenth that amount. The author estimates that the forest will eventually give employment at the rate of one family for 75 acres, while dairying requires 201 acres per family. There is food for thought in this statement as well as in the following sentence: "New Zealand wants population more than wealth."

A. F. H.

Continuous Forest Production in the Pacific Northwest. Burt P. Kirkland. The Commonwealth Review of the University of Oregon, July, 1918, pp. 63-78.

There has been no period in American history, aside from the present, when the imperative need for continuous forest production on private as well as public forest lands was so apparent. The war has emphasized the need of forests in national defense far beyond any realization of the past. The rapidity with which the remnants of our virgin stands are being exploited, particularly in the East, and the lack of reproduction and adequate fire protection after lumbering are such the future timber supply for this country is insecure. It is coming more and more to be realized that continuous crop production on our present acreage of publicly-owned forests is inadequate for the future. There should be established at once a strong forest policy which recognizes national, State, and private forest enterprises, all working in co-operation with a single object in view, namely, the continuous production of timber on absolute forest land.

With about 97 per cent of our annual cut coming from privately-

owned forests, which constitute four-fifths of our total forest area, it needs no argument to prove that continuous forest production must become the practice on privately-owned forest land.

Professor Kirkland, to whom American forestry owes much for his writing on permanent forest industry and continuous forest production, has, in the article under review, emphasized the lack of national foresight and the great economic waste in the continuation of forest exploitation in the Pacific Northwest, where most of our remaining large areas of virgin timber still exist. The writer of this article does not believe that all absolute forest land should be publicly owned, but he does believe in the necessity of a forest policy that makes continuous production of timber possible on private lands. He believes that even in the Pacific Northwest five or ten years will mark an end to the present system of exploitation without reproduction. He believes that private owners must accept reforestation as a policy, either voluntary or under public compulsion.

The reviewer of this article believes that any form of continuous forest production on privately owned forest land, insisted on by the public, must provide against economic loss to the private owner. He ardently supports the idea of permanent forest industries and continuous forest production, but believes the time is now at hand when it can be attained through co-operation between the private owner and the public. He believes that a way can be found or made mandatory under which the private owner will forego a part of the present profits from exploitation and organize his forest lands for continuous production and permanent industries in exchange for public assistance in carrying charges, taxes, and fire protection. The benefits to the public from continuous production and the resulting permanency in forest industry and the public benefits from the indirect value of the forest must be recognized more fully than at present. The way to the establishment of forestry on private forest lands is true understanding, in which the rights of both the private owner and the public are fully appreciated.

Professor Kirkland places our present ownership of forest property as a whole under three classes, so far as continuous production is concerned, as follows:

A. Economic holdings from standpoint of continuous forest production.

	Acres
1. Public forests, mostly Federal	113,000,000
2. Farm woodlots	200,000,000
3. Private holdings of lumber and pulp companies and other forest owners in selection forest region of northeast United States (estimated)	41,000,000

B. Debatable.

1. Private holdings in hand of holders having one billion feet or more of standing timber	46,000,000

C. Clearly uneconomic in the main.

1. Small holdings in hands of lumber companies and other owners not integrated with other industries or otherwise specially favored and not commanding cheap capital	145,000,000
Total	545,000,000

His conclusions as far as the Pacific Northwest is concerned are as follows:

1. Require that all permanent forest lands be reforested to at least 75 per cent full stocking following cutting. The cost of this is so small that it is not unreasonable to put in on the private owner as a part of his obligation as a trustee of an important renewable natural resource.

2. Require protection of young growth from fire. In case any is destroyed the owner should be required to reforest. This will insure efficient protection.

3. Begin consolidating ownership in economic hands and in workable units for continuous forest production.

4. Place each tract on a continuous sustained-yield basis, so that each year income will be available to meet all expenses and pay annual returns on the investment, just as a farm or railroad or a city block pays annual returns.

J. W. T.

Effect of Grazing upon Aspen Reproduction. A. W. Sampson. Bull. 741, U. S. Department of Agriculture. Contribution from the Forest Service, Washington, D. C. 1919. Pp. 29.

The regulation and control of grazing is of far-reaching importance in the organization of absolute forest land for the continuous production of crops of timber. Too often in the past we have sacrificed reproduction in order to placate the cattle and sheep men. We have sacrificed reproduction at the most opportune time for obtaining it, and now it can only be secured by planting, often at prohibitive costs.

Throughout most of the West grazing on absolute forest land is of vast economic importance, and the forester accepts the general principles that grazing must be carried on as a part of forest management. He does not object so much to grazing as he does to unregulated grazing. In many parts of the West the present economic importance of grazing so overshadows the importance of the forest for the produc-

tion of timber that there is grave danger in overgrazing much of our absolute forest land, which will lead to a gradual destruction of the timber now standing and more or less complete elimination of reproduction following fires and lumbering.

One of the most important problems dealing with large areas of our absolute forest land is how intensively can it be grazed without serious injury to it as a forest? The many researches conducted by the United States Forest Service and by other agencies in recent years have thrown much light on our grazing problems in their relation to natural reproduction. Sampson's recent bulletin, dealing entirely with the effect of grazing upon aspen reproduction, clearly shows that great damage to the natural regeneration of this species results from both sheep and cattle grazing, although the regeneration usually appears in dense stands and is almost entirely from root suckers.

There is little or no aspen reproduction until the stands are severely opened up by lumbering or fire. Fully stocked reproduction is best after clear-cutting. The author's studies appear to show that even where sheep in moderate numbers are permitted to graze on such clear-cut areas the aspen reproduction is often destroyed, almost to the last sprout. The damage done by sheep is much greater than by cattle, and the damage by both depends upon the duration and intensity of the grazing. Sampson's studies extended over a period of five years and were conducted on the Manti National Forest, in central Utah, a region in which pure stands of aspen are of high value and cover considerable areas. Sample plots were established on clear-cut areas, which were studied each year and records made of the reproduction. Some of the plots were lightly grazed, others moderately grazed, and still others heavily grazed. The amount of damage on all plots varied somewhat with the season. The mortality of one-year-old sprouts, even under light grazing, is so high it is reasonably sure to have a determined effect on the stand of timber.

If the sprouts that appear the first year after clear-cutting are destroyed by grazing the sprouts, the succeeding year, are much less vigorous. Those produced the third season and later are distinctly lacking in vigor and are of little value for regeneration. Aspen sprouts grow rapidly, and at the end of three years they attain a height which exempts them from destructive grazing by sheep, and after four or five years are damaged little by cattle. The problem, therefore, seems to be the protection of reproduction for a period of three or five years after clear-cutting, or at least to protect it adequately to assure reproduction in fully stocked stands. Although the writer believes that very

light grazing by sheep may do little harm, he does not believe it practical to attempt sheep grazing for a period of three years after clear-cutting. He is of the opinion, however, that the moderate grazing of cattle will still permit a sufficient number of sprouts to survive to form a fully stocked stand. It appears to be necessary in order to obtain an aspen reproduction to either exclude stock altogether for a period of three years, or in the sheep country to shift from sheep to cattle for a three-year period when sheep can again be safely grazed. Where the aspen is not in a cattle country the only necessity in order to obtain reproduction is to control the grazing and properly distribute the stock by means of drift and division fences.

The bulletin under review is additional evidence of the great injury to forest reproduction on absolute forest land by uncontrolled and unregulated grazing. The accumulated evidence of the past decade should force every thoughtful man to the realization that grazing is a serious menace to the natural reproduction of forests. The first duty of the forester is reproduction. Upon him falls the responsibility for successful crops of timber on absolute forest land under his control. It is his duty, therefore, and not of the stockman, to determine when and where stock should be grazed and when they should be excluded from given stands. It should be his province to decide the grazing possible within the limits of good forestry. The pressure for grazing areas in the West must not force grazing beyond the limits of the forest, thus causing its detriment and possible destruction.

J. W. T.

The Administrative Report of the Virginia State Forester for the Calendar Years 1916 and 1917. Charlottesville, Va. 1918. Pp. 81.

Like several other States, Virginia has lately placed her forestry interests into the keeping of her Geological Commission, with a State Forester appointed by the Commission, which is composed of the Governor, the President of the University of Virginia, the President of the Virginia Polytechnic Institute, the Superintendent of the Virginia Military Institute, and one citizen appointed by the Governor.

The office of State Forester was created in 1914; the State Forester was appointed in 1915 and made at the same time professor in the University of Virginia, which, also, bore the expenses (some $5,000) until special appropriations were made in 1916 ($10,000) and furnished office and nursery grounds. The work grew so rapidly that two assistant foresters had to be appointed. This work consists in: Forest fire-

protection measures, for which co-operation of the Federal Government has been secured and distinct progress is being made; co-operation with land-owners in forestry practice; investigation of and reporting on methods of conservation of forests, etc., by counties, including stock-taking, some having already published reports, while others are preparing them; popular education in forestry by means of correspondence and personal interviews, etc. A large amount of printed matter devoted to educational propaganda is listed already in the way of leaflets, bulletins, posters, news items, lectures, etc.

Lack of funds would have prevented the organization of a protection service but for a generous interpretation by the Federal Forest Service of the Weeks law and financial co-operation by counties and private owners, permitting the appointment of a respectable force of patrolmen. By co-operation of a private forest owner, too, a demonstration area was secured, and by that of the university a State forest nursery.

Practical advice was given to forest owners regarding management and utilization of their woodlots, and a number of lecture courses were instituted.

In an appendix the forestry laws of the State are given. A few minor changes are suggested and a modest increase of appropriations is asked.

B. E. F.

Annual Report of the State Forestry Board of the State of Minnesota for the Year Ending July 31, 1918. 1919. Pp. 19.

No academic discussion here! This report of less than 20 pages is business from beginning to end. It is divided in two sections: work accomplished in 1917-18 and recommendations, signed by the nine commissioners and their secretary, the venerable Gen. C. C. Andrews, but evidently written by State Forester W. T. Cox in vigorous style.

The report starts with a financial statement, showing an expenditure of some $60,000. It is interesting to note that the Itaska and Burntside State Parks, through sale of dead and down timber, sale of beaver skins, and a lease, appear on the credit side with several thousand dollars, after the Governor had vetoed appropriations for same.

Forest fire protection receives, of course, the first place. Depletion of the ranger force through enlistment and unfavorable weather conditions in the northern districts combined to render this service less efficient than ordinarily, although the Federal Government helped financially, railroads had 136 patrolmen out, lumber and mining companies employed 25 or 30, and 62 townships levied all or part of the five-mill fire tax to employ patrolmen and install telephones.

Although the disastrous conflagration of October 12, 1918, did not occur within the time of the report, it is specially discussed in an appendix as to cause and character, and on an accompanying map the extent of the damage is stated:

Number of lives lost, 432.
Area burned over, 200,000 acres.
Total area burned over, much of it lightly, 600,000 acres.
Approximate loss, $25,000,000.
Number of homes burned, 5,000.
Number of towns and villages, 11 entirely burned, 5 partly burned.

Having shown the utter inadequacy of present provisions for forest fire protection, an annual appropriation of $330,000 is argued as necessary, besides a permanent emergency fund of $75,000, to be drawn upon in extraordinary years.

Besides the small State parks, there are now 300,000 acres of State forest under control of the Board.

Lack of funds hamper the administration of the new State forests. Classification of the land and timber and a taking of stock are necessary. Fifteen forties were surveyed to determine the best methods for the work and the cost. Fifty-three sales of timber were made within these new forests, including pine, spruce, cedar, and other species, valued at $150,000, mainly timber injured by fires, wind, high water, or insects. In green-timber logging operations a forest officer marks trees to be left uncut for seed or as basis of a second cutting.

Arguments and plans for an increase of State forests are discussed. An extension of control by the Board to the sale of timber from the State school, swamps, and other lands is suggested, just as the work of the Surveyor General in scaling and collecting fees on timber cut is now in the hands of the State Forester.

There are three ways in which the land might be acquired: (1) By immediate purchase; (2) by the exchange of State timber for private lands, and (3) by the long-time lease of these private lands by the State, with the option to buy. The leasing of the land, with option to purchase, seems to be the best plan. Under this arrangement the immediate possession of extensive areas would be possible, while the expense of the purchase, if such purchase ultimately seemed advisable, could be spread over a long period of years and would not involve large initial expenditure.

The acquisition of this land by the State at some time is practically certain, and it can never again be acquired as cheaply as now.

Reference is made to war work, the State forester having acted as

special recruiting officer for forest engineer regiments and approximately securing a thousand men, the forester also acting as special adviser to the Regional Committee on War Industries.

The most striking recommendation has reference to an attempt to make the Forest Service independent of appropriations by successive legislatures, since a "permanent policy is involved demanding a constant and dependable source of revenue." To this end a special State tax of one-sixth of a mill is proposed to be levied for the support of the Forest Service. A bill to provide such a tax has been introduced in the legislature. Such a tax, we learn from the *North Woods*, for February, will provide approximately $37,000. Other legislation to prevent careless setting of fires and reorganizing the forest protective service are also introduced. To all appearances, the Minnesota forest policy seems in a fair way of rational advance.

From an article in the same issue of the mentioned journal, we reproduce a few statistical data regarding forestry matters in the State. The timbered area of the State includes approximately 27,000,000 acres, the value of timber products alone thereon amounting to $500,000,000. From this area, up to July 31, 1918, the State revenue from timber cut was $10,197,894, the money going largely to the university and school fund. The total yearly value of the "forest cut," including private ownership as well as the State, amounts to over $40,000,000. It is probably well within the facts to say that during the last 25 years over 2,000 lives have been needlessly sacrificed to forest fires, and that the total loss of property during this period from the same cause amounts to $58,000,000; also, forest fires are responsible for the loss of vast areas of young growing trees on cut-over lands, which can be estimated at $1,000,000 per year (to say nothing of the loss of soil through impoverishment and denudation), making a total property loss of $83,000,000.

The first of a series of recent great forest fires in the State occurred in Virginia in 1893, when the town was practically destroyed. Next came the Hinckley fire, in 1894, when 418 people lost their lives. On September 4, 1908, there occurred a fire in which the village of Chisholm was destroyed, with no direct loss of life, though from the exposure several women and infants died. The towns of Beaudette and Spooner were destroyed and the country around devastated by the fire of October 7, 1910, entailing the sacrifice of 32 lives. The most recent fire, that of October 11 and 12, 1918, burned over an area of 350,000 acres, the towns of Cloquet and Moose Lake being wiped out, the property loss being over $50,000,000 and the lives sacrificed over 500.

B. E. F.

Seventh Biennial Report of the State Forester of the State of California. By G. M. Homans. Sacramento, Calif. 1919. Pp. 103.

It is a sad reflection that the State, which was the first—more than a generation ago—to recognize State interest in forestry by the appointment of a State Board of Forestry, has not yet recognized its first duty in giving expression to such interest. The first sentence of this report and the last page containing the financial statement justify this arraignment. "California makes no appropriation for controlling the many fires which annually destroy its grain, range, and timber."

Less than $25,000 a year is spent in supporting the forest interests, which give rise to an annual lumber cut valued at around $29,000,000, and leaving the State Forester mainly to academic discussions and to side issues, such as the planting of shade trees, park designs, and the like.

"The fire records of California indicate that the State is not doing its duty in respect to fire protection." In 1918, 333,000 acres (timber, brush, grass, and grain) were burned, causing damage of around 1.5 million dollars. There are laws, but no adequate machinery to carry them out. In the absence of State activity in this direction, some of the counties have taken the matter in hand, partly in co-operation with private owners. As a result of the instigation by the Food Administration and through the Forest Industries Committee, of which the Forester was chairman, these county organizations were extended. There are also five more or less local private protective associations reported.

Forest planting in the arid regions of southern California for windbreaks, ornament, shade, and fuel is discussed on 12 pages.

Some 26 pages are devoted to a brief account of forest distribution and a description of the principal trees of California.

The white-pine blister rust comes in for discussion, although not yet in California. An embargo on importations that might introduce it is in existence.

Besides the biennial reports of the State Board since 1912, bulletins have been issued on the following subjects:

Yield of Eucalyptus Plantations in California, Bull. 1.
Wood-using Industries of California, Bull. 3.
Street and Highway Planting, Bull. 4.
A Discussion of Log Rules, Bull. 5.
A Mill Scale Study of Western Yellow Pine, Bull. 6.
Wood Utilization Service, Cir. 6.
Table Showing Board Feet Contained in Lumber of Various Dimensions.
Handbook of Forest Protection, 1918.

B. E. F.

Report of the Forest Branch of the Department of Lands of the Province of British Columbia for the Year Ending December 31, 1918. Victoria, B. C. 1919. Pp. 27.

This report consists almost entirely of statistical tables, with little comment. It reveals the fact that the Forest Branch is after all merely a timber-land administration and has nothing to do with forest management. The word "forestry" does not occur once, and no allusion is made to the subject-matter comprised in that word, unless a brief reference to slash disposal in connection with fire protection may be so construed.

The most interesting item is an account of the effort to increase the spruce production for airplane construction. It appears that the provincial government commandeered all (Sitka) spruce supplies.

This order was subsequently supported by the "Spruce-cutting Act." Compensation was given to the owners of expropriated timber at a flat rate of $6 per thousand board feet for No. 1 and $2.50 for No. 2 grade spruce logs.

Organized effort increased the output from month to month from 116,000 feet in June to 6,850,000 in November, altogether 26,124,000 feet of a material hitherto neglected, valued at over $114,000,000. At this time British Columbia was more than equaling the entire production of the Western States, with all their resources in men and material—a result accomplished in eight months.

The year's total lumber product, including shingles, lath, poles, piles, ties, fence posts, etc., is stated as 1,545,000,000 feet, over 50 per cent increase on 1915 figures, with an estimated value of over $54,000,000, as against $29,150,000, and yielding a revenue from all forest resources of $2,730,800. The general expenditures were a little short of $118,000, while the government's contributions to the forest-protection fund were $104,000, licensees paying an equal amount, the total expenditure in this direction amounting to around $229,000.

There are not quite 900,000 acres of private lands, valued at $9.60 per acre, but the extent of government lands in various conditions is not stated. B. E. F.

Department of State Lands and Forestry of the State of Maine. Bulletin 2. 1918. Pp. 72.

This publication is peculiar, from the bookmaker's point of view. That it refers to the State of Maine appears only from the letter of transmittal, and that it is really the annual report of the department

from the perusal. Without any introductory remarks, it starts with a financial statement of the cost of fire protection. Without table of contents, we find them divided into five sections, each with a whole page heading, namely: Fire Protection, Maine Forestry District; Fire Protection, Outside Maine Forestry District; Public Lands, 1918; State Nursery and Forestry Department at the University of Maine, 1917-18; White Pine Blister Rust Work in the State of Maine, 1918.

The department consists in a Land Agent and Forest Commissioner, a Deputy Forest Commissioner, a Director of Public Instruction, and six clerks. Nearly two-thirds of the report is taken up by the subject of fire protection.

Apparently the cost of fire protection on the "Maine Forestry District" (not defined) is covered by special assessment and by a grant from the Federal Forest Service, there having been spent a little over $100,000. With 58 lookout stations, the district seems well served, and with an expenditure of $31,000 for permanent improvements the system seems to be well kept up. While the damage on the 3,820 acres burned within the district was kept within $7,500, the damage outside the district ran up to over $70,000 on 5,118 acres. The railroads are praised for effective assistance in helping to enforce the slash law.

It appears that the forestry department at the Agricultural College is organically connected with the Forest Commission, the Professor of Forestry reporting to the Forest Commissioner. A small forest nursery, largely worked by the students, sells stock to would-be planters and is on the point of becoming self-supporting. The same professor (John M. Briscoe) also reports on the white pine blister rust work in the State, on which $8,820 were spent, about one-half furnished by Federal funds. The most interesting part of the report refers to the per-acre cost determination of this work, which finally works out to 82 cents per acre. B. E. F.

The Regenerative Forests of Eastern Kentucky and Their Relation to the Coal Mining Industry. By J. E. Barton. Circular 8. Office of the Commissioner of Geology and Forestry. Pp. 4.

Kentucky is one of the States where forestry is joined to geology, a commissioner taking care of both interests, the *quondam* State Forester having become such Commissioner.

In this short circular the relation of mine and forest in the section under discussion is interestingly analyzed and the "regenerative" character—that is, the tendency to natural regeneration—of the hardwood forest accentuated.

In the present stands of native growth it is possible to cut 176 props per acre, while the mines require 573 props to the acre mined. The disproportion is largely due to the size of the timber; it does not pay to use the larger sizes, which must be cut to size. In the regenerated stands relatively even-aged the output of props "could be increased at least 100 per cent." "The ideal forest for use in connection with the coal-mining industry is an even-aged stand of trees of pole size, such as ordinarily can be raised in a period of about 30 to 50 years."

"There is no question that the regeneration of the forests of eastern Kentucky is a certainty, providing only that adequate protection is given against fire and grazing." This refers to coppice as well as seedling growth of broadleaf species. Shortleaf pine also readily reproduces itself and "can be easily managed in 25 to 30 year rotation."

B. E. F.

The Preservation of Wood. By A. J. Wallis-Tayler. D. Van Nostrand Co. New York.

In this book there is a chapter on the "Seasoning or Drying of Wood" which is worth reading for any one making a study of this subject. It is of chief interest in giving a brief résumé of the methods of kiln-drying, past and present, used on the Continent. The book is evidently an English publication and without date, but was written subsequent to 1914, according to material quoted therein. No reference is made to American dry-kilns. The Sturtevant three-duct kiln, the Wells progressive forced-draft kiln, and the natural draft Erith's progressive drier are described in considerable detail, all of which are English makes. Early designs and patents are briefly described—one in 1837, by De Mecquenem, in which heated air is forced into the drying chamber near the floor and escapes near the roof. Methods of soaking in fresh and salt water, of treatment to pressure steam in closed cylinders, drying in smoke, treatment in ozone, replacement of sap by boro-resinate of soda by means of an electric current (the Nodon-Bretonneau process), and the charring or scorching of wood are touched upon, but not fully discussed. The information, though very incomplete, is perhaps the best which has been written on this subject as touching the English conditions.

H. D. T.

RECENT PUBLICATIONS

BOTANY AND ZOÖLOGY

The Biology of Polyporus Pargamenus Fries. By A. S. Rhoads. Technical Publication No. 11, New York State College of Forestry at Syracuse University. Vol. xviii, No. 5. Syracuse, N. Y. 1918. Pp. 197; pls. xxxi.

A Study of Heart-Rot in Western Hemlock. By J. R. Weir and E. E. Hubert. Bulletin 722, U. S. Department of Agriculture. Contribution from the Bureau of Plant Industry. Washington, D. C. 1918. Pp. 39.

Report of the Entomologist, 1916-17. U. S. Department of Agriculture. Washington, D. C. 1918. Pp. 24.

FOREST GEOGRAPHY AND DESCRIPTION

The New Manitoba District, Canada: Its Resources and Development. By F. H. Kitto. Department of the Interior. Ottawa, Canada. 1918. Pp. 43.

POLITICS, EDUCATION, AND LEGISLATION

Production of Lumber, Lath, and Shingles in 1917. By F. H. Smith and A. H. Pierson. Bull. 768, U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1919. Pp. 44.

Biennial Report of the Forestry Commission of New Hampshire for the Two Fiscal Years Ending August 31, 1918. Concord, N. H. 1918. Pp. 127.

Report of the College of Agriculture and the Agricultural Experiment Station of the University of California, July 1, 1917, to June 30, 1918. University of California Publications. Berkeley, Calif. 1918. Pp. 139.

Fifty-eighth Annual Report of the Crown Land Department of the Province of New Brunswick for the Year Ended October 31, 1918. Fredericton, N. B. 1919. Pp. 188.

Private Forestry. By H. S. Graves. Circular 129, U. S. Department of Agriculture. Office of the Secretary. Washington, D. C. 1919. Pp. 11.

SILVICULTURE, PROTECTION, AND EXTENSION

Making Best Use of Idle Lands in New York. By J. W. Stephen. Circular 19, New York State College of Forestry at Syracuse University. Vol. xviii, No. 6. Syracuse, N. Y. 1918. Pp. 53.

Thirteenth Annual Report of the Cœur d'Alene Timber Protective Association. Cœur d'Alene, Idaho. 1918. Pp. 12.

Effect of Grazing upon Western Yellow Pine Reproduction in Central Idaho. By W. N. Sparhawk. Bulletin 738, U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1918. Pp. 31.

Control of Ground Squirrels by the Fumigation Method. By G. R. Stewart and J. S. Burd. Bulletin 302, University of California Publications. Berkeley, Calif. 1918. Pp. 207-224.

Effect of Grazing upon Aspen Reproduction. By A. W. Sampson. Bulletin 741, U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1919. Pp. 29.

SOIL, WATER, AND CLIMATE

Water Power Resources of the State of New York. Supplement to Eighth Annual Report of the Conservation Commission. Albany, N. Y. 1919. Pp. 45.

What the National Forests Mean to the Water User. By S. T. Dana. U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1919. Pp. 52.

UTILIZATION, MARKET, AND TECHNOLOGY

Pulpwood Consumption and Wood-Pulp Production in 1917. By F. H. Smith. Bulletin 758, U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1919. Pp. 19.

Creosote Treatment of Jack Pine and Eastern Hemlock for Cross-Ties. Bulletin 67, Dominion Forestry Branch, Department of the Interior. Ottawa, Canada. 1919. Pp. 24.

The Use of Wood for Fuel. Compiled by the Office of Forest Investigations. Bulletin 753, U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1919. Pp. 40.

Philippine Bamboos. By W. H. Brown and A. F. Fischer. Bulletin 15, Department of Agriculture and Natural Resources. Bureau of Forestry. Manila, P. I. 1918. Pp. 32; pls. xxxiii.

Philippine Forest Products as Sources of Paper Pulp. By W. H. Brown and A. F. Fischer. Bulletin 16, Department of Agriculture and Natural Resources. Bureau of Forestry. Manila, P. I. 1918. Pp. 13.

MISCELLANEOUS

Recreation Uses on the National Forests. By F. A. Waugh. U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1918. Pp. 43.

Attracting Birds to Public and Semi-Public Reservations. By W. L. McAtee. Bulletin 715, U. S. Department of Agriculture. Contribution from the Bureau of Biological Survey. Washington, D. C. 1918. Pp. 12.

BOTANY AND ZOÖLOGY

Key to Woods

The following is a key for distinguishing, with the aid of a pocket lens, wood of the conifers grown in central Europe:

A. Woods without colored heart.
  1. Without resin ducts.
    Fir—*Abies pectinata*.
  2. With fine resin ducts.
    Spruce—*Picea excelsa*.

B. Woods with colored heart.
  1. Without resin ducts.
    (*a*) Hard and heavy woods.
      Heart dark brown; sap narrow, yellowish; annual rings irregularly circular (undulating).
        Yew—*Taxus baccata*.
    (*b*) Soft and light woods.
      *Sap very wide, yellowish; heart rose red; agreeable odor.
        Pencil cedar—*Juniperus Virginiana* (North America).
      **Sap wide, yellowish; heart light brown; odor almost lacking.
        Common juniper—*Juniperus communis*.
  2. With resin ducts.
    (*a*) Hard and heavy woods. Fallwood sharply distinguished on both sides.
      *Sapwood wide, even on old trees; heart brown (light when freshly cut); resin ducts numerous and distinct; knots in whorls.
        Scotch pine—*Pinus silvestris*.
        Austrian pine—*Pinus laricio*.
      **Sapwood on old stems, narrow; heart red brown (dark when freshly cut); resin ducts less numerous and finer; knots scattered.
        Larch—*Larix Europea*.
    (*b*) Soft and light woods. Fallwood not sharply distinct on inner side. Knots in whorls. Resin ducts very plain.
      *Mostly narrow-ringed; knotty (year's growth is short); heart light brown; bark fissures brown.
        Stone pine—*Pinus cembra*.
      **Few knots (year's growth long); heart pale violet brown. Bark fissures pale violet.
        White pine—*Pinus strobus*.

W. N. S.

Naturwissenschaftliche Zeitschrift für Forst-und Landwirtschaft. Jan.-Feb., 1918, pp. 98-99.

SILVICULTURE, PROTECTION, AND EXTENSION

Reforesting Pine Areas in France

It is interesting to record that the activities of the American forestry battalions did not consist in forest utilization alone. Captain H. D. Hopkinson reports that "in return for being permitted to clear-cut large areas of pine in the forests of Brotonne and Rouvray, it was agreed, at the request of the

French forest authorities, that the British Army should resow with Scots pine seed the areas felled.

"Sowing commenced in 1918, and in the spring of that year 146 acres were sown in the forest of Brotonne and 160 acres in the forest of Rouvray. The soil generally speaking is sandy in both cases, and in Brotonne there is a large admixture of flints which in places impeded the preparation of the 'pits.' The 'pits' were made at the rate of 2,420 per acre, and consisted of areas 1 foot square, which were cultivated to a depth of 6 inches; where turf existed this was thrown aside. The 'pits' were made during the winter, and the sowing (in Brotonne) commenced on April 1 and finished on the 23d of that month.

"In my opinion, the areas could have been more surely and successfully reafforested by the planting of strong, good-sized plants that could have withstood the weeds, but the French forest authorities desired the area to be sown. As the felling operations proceeded the stumps of the felled trees were barked, and then charred by burning the brushwood in heaps upon them.

"These operations were carried out at the express request of the French forest officers with the object of minimizing the risk of a rapid increase in the number of pine bark bettle (*Hylesinus piniperda*) and pine weevil (*Hylobius abietis*).

"Prisoner-of-war labor was employed, and the following tasks were done:

"Barking stumps (done previous to felling)—15 to 16 trees per man per day.

Burning stumps—10 to 15 stumps per man per day (including collecting brushwood, igniting and watching fires).

Preparation of pits—250 pits per man per day.

Sowing—gang of 20 men did 10,000 pits per day (9 men raking, 3 men stamping, 4 men sowing, and 4 men covering)."

Transactions of the Royal Scottish Arboricultural Society, January, 1919, pp. 69-70.

MENSURATION, FINANCE, AND MANAGEMENT

Working Plans in Switzerland and Elsewhere

Although the Federal law of 1876 prescribed the elaboration of working plans for the public forests of the Swiss cantons, 12 cantons of the 25 are still without such plans or even an instruction for making such, while in six cantons the plans made thirty and more years ago are antiquated and need revision. Flury discusses at great length the guiding points for such revision, and first briefly refers to the revisions which were ordered

under new instructions in several German States (in 1910-12) and in Austria (1908).

In France there is no single instruction, only certain traditions dating back to 1820 form the basis of working plans, with gradually more modernized notions. In Bavaria, Württemberg, and Prussia only State forests are involved, in Baden and Alsace-Lorraine, as in Switzerland, municipal forests are included in the instructions.

In some of these States a special working plan bureau does the work, in others it falls all or in part to the administrative officers.

Besides the fact that in these countries in the main State forests are involved, the author accentuates that mostly a clearing or short-time regeneration system is the silvicultural basis, and hence the area is prominent as regulator. In general, however, even here principles and aims of management and silvicultural considerations are to influence the felling budget more than hitherto.

As regards growing stock and increment, the Prussian instruction does not consider ascertainment of them needed in selection forest, and for other systems only the stands of the I (oldest) period (20 years) are to be calipered. In Alsace-Lorraine, besides the same prescription for the oldest age-class, the contents of near-ripe stands of the II period are to be ascertained by sample area method; here, in selection forest all trees above 3 inches in the oldest age-class are to be measured. In Baden, only the stands that come to use in the next decade and those in process of generation are calipered. In Austria, it is permissible to ascertain growing stock by measuring sample areas on 5 per cent of the mature and near-mature stands. Bavaria also ascertains only the growing stock for the next 10 years fellings by either calipering or by estimates. Similarly, Saxony is satisfied with estimates on the basis of yield tables.

The current increment plays a greater rôle than formerly, ascertained by stem analysis with use of sample areas and yield tables for one or two decades.

In Switzerland, however, a farther reaching direct inventory is considered necessary (probably because of less uniform conditions).

As stated, the normal felling area plays a prominent part in determining the felling budget for the clear cutting timber forest, even in Baden, where natural regeneration is most developed and where Heyer's volume budget formula is used as a check. In France, too, in many places the area allotment plan is used, when the growing stock on the periodic (20 years) area of the oldest age-class is also ascertained and divided by 20 to get the annual felling budget in volume and

value, not forgetting, however, the ordinance of 1669 which provides one quarter to be placed in reserve.

For the selection forest in Baden, first a "preliminary" felling budget is made up of decadent trees and such as are to be removed from silvicultural considerations and the final budget is then based on the Heyer formula, using, however, for the increment the current total increment, and not the final felling age increment.

In Prussia and Alsace-Lorraine the annual average increment is used in the same formula.

The requirement of an age-class table with areas, and a calculated rotation appears to the author not germane to the character of the selection forest and contrary to its nature, at least in Swiss conditions.

After having referred to the fact that in Prussia for forest subdivision a rationally projected net of roads is made the basis, the author criticizes the attempts of the various instructions to introduce theoretical discussion on determining rotation by soil rent and forest rent and index per cent calculations, since "these old polemic questions are mainly of managerial, that is, silvicultural nature, which cannot be secured by organization but by a rational treatment of the woods; a silviculture based on natural history is still lacking."

Turning now to the principles which should underlie Swiss instructions for working plans, the author suggests that a general statement of the object of public forests is desirable. Increase of production and making useful waste places may be stated as the foremost aim, and the political questions of administrative organization to attain this object in Switzerland are discussed. A complete systematic schedule of "leading points of view," that should guide the organizer in political, economic, and technical direction, is given on four pages and discussed at length. We brief only the more technical parts of general interest.

In the section on increment the author demands that ascertainment of stock and control of felling budget must in the working plans and their revisions form a whole built on the same principles to furnish the basis for a correct increment determination, the total periodic increment being the most acceptable measure for judging the influence of management. Since the maximum of volume and value increment do not coincide in time, it is the business of organization to find and work for the most advantageous relations between stock and increment. The dangers and errors in ascertaining current increment of stands by analysis of sample trees is accentuated, since this method is still recommended by authorities. A correct stand increment statement can be arrived at only by repeated complete measurement

of stands. The use of the average increment at felling age (Heyer's proposition, which we consider most logical for felling budget calculations) is discouraged without argument. The average increment, volume divided by age, which if the stock is measured and its age determined and not merely estimated, is a truthful statement, is declared of no use in selection forest. Only the current (or periodic average) increment gives satisfactory indication of the effect of silvicultural measures and fellings, besides being the sustained yield felling budget. To be sure, this current increment can only be secured by repeated measurements. The relation between current, average periodic and average increment at felling age is discussed upon the basis of a curve and table. For mountain spruce on III site for the whole rotation the following average values in cubic feet per acre for main stand are found.

	Timberwood	Total
Average increment at felling age	95.8	107.2
Average increment (of all age classes) mean for rotation	94.4	120.0
Current increment mean for rotation	111.5	116.0

From this the author is forced to admit that the use of the average increment at felling age was after all not so faulty. Nevertheless, he considers that the average increment (secured by dividing the age of each age class into its volume) represents best the performance of the stands; its total and mean value represent the annual sustained yield and felling budget *in toto* and per acre unit. Only when middle-aged stands are prevalent and older stands are deficient it works out too high, but then the normal stock comes also out relatively too high and furnishes a compensating factor.

The author accentuates the need of proper bookkeeping in order to secure for the revision of working plans more and more reliable increment data.

An important question from the regulator's point of view in controlling sustained yield management is the distinction between main and intermediate yield. In the selection forest based on diameter classes there is no difficulty in this distinction; all that is cut above a certain diameter is main yield. For timber forest it has been suggested to use the same method, but with the many thinnings that are practised in such forest it is too circumstantial and changes the management of stands to a management of trees, and loses the advantages of our knowledge of the development of the stand, as exhibited in yield tables, with their normal stock, given number of trees, etc. The importance of booking correctly the intermediate yield is brought out by a statement of the per cents which the customary, medium severe

thinnings represent, namely 28 to 40 per cent of the stock in 60-year stands, and 12 to 15 per cent of the total increment in the 100-year stands.

The author also fears that by booking part of the thinnings as main yield, the public interest (of communal forest owners) in a more intensive thinning practice would suffer.

In timber forest where stands can be differentiated by age classes, the age of the stand furnishes the best basis for distinguishing the character of the utilization as main or intermediate yield. Only in the last third of the rotation doubts would occur; when regeneration is the object, the cut will have to be considered as part of final yield, so will forced fellings as consequence of storm and snow breakages, insects, etc. Instead of summary estimates of thinnings, definitely planned ones are suggested, as a percentage of the stock of the stand. A table is given which, for spruce and beech, gives such percentages for 10-year periods. For spruce in hill country, on the better sites, these percentages in timberwood run for the decade mostly between 10 and 12 per cent. These represent the side stand which would die if not utilized.

Much stress is laid on the ascertainment of the stock on hand, which is considered as more important than the area. The author is not satisfied, as the German instructions are, with an ocular estimate using yield tables and sample areas. In uniform and even-aged forest this may do, and where the data of production have already for a long time been controlled, and in State forest. But in Switzerland, with 68 per cent communal forest, a relatively small forest area and high demand for wood, and lack of information of production, a more exact knowledge of stock is needed. Especially knowledge of the composition of stock in diameter classes is needed to give insight and answer to a number of important practical questions. Especially the increment can hardly be ascertained without exact ascertainment of stock. The cost of such careful ascertainment of stock is soon compensated.

An example is given, in which in three decadal revisions due to careful stock measurement the annual felling budget was found to be capable of a raise of nearly 50 per cent. And if a deficiency were discovered, this would be just as important.

For the sake of economy this careful measurement may be confined to the stands in the second half of the rotation, for in a rotation of 100 years the stands of 61 to 100 years represent 65 to 80 per cent of the total stock of a management class; and if diameter classes are

taken, the percentic distribution in normal stock of timber forest, if all trees of 6 inches and more are calipered, will also on average sites show 75 to 85 per cent of total normal volume for 100 to 120 year rotation.

A table is appended, showing the ideal distribution of stock in spruce and fir selection forest, provisory values, according to whether 3, 4, or 5 size classes are formed. This table gives an interesting insight into the composition so that we translate it in part.

Percentic, Ideal Distribution of Stock in Fir and Spruce Selection Forest

Timberwood per cent

Size class, d. b. h. Inch	*Site* I	II	III	IV	V
In five diameter classes:					
2- 5	2.4	2.9	3.3	4.0	4.8
6-10	5.2	7.1	10.0	13.7	18.3
11-16	14.5	20.6	28.7	37.0	43.6
17-24	36.6	44.1	45.0	39.9	32.3
Over 24	41.3	25.3	13.0	5.4	1.0
In four diameter classes, as practiced:					
6-10	5.3	7.3	10.3	14.3	19.2
11-16	14.9	21.2	29.7	38.5	45.9
17-24	37.5	45.5	46.5	41.6	33.9
Over 24	42.3	26.0	13.5	5.6	1.0
In three diameter classes (méthode du contrôle):					
8-12	8.7	12.7	18.9	26.2	35.1
14-20	28.7	38.5	47.4	53.1	53.4
Over 20	62.6	48.8	33.7	20.7	11.5

In the estimating of young and middle-aged stands a comparison with normal conditions is all that is needed, so that yield tables and sample plots give sufficiently accurate results. However, care must be taken to avoid errors in comparing the density, in rounding off diameter classes, and in calculating the cubic contents by multiplying the length of logs by the middle area. Young stands should be inventoried at each revision of the working plan.

Errors in estimating mature timber arise mainly from the following sources:

1. Choosing sample trees which are not representative.
2. Using volume tables not applicable to local conditions.
3. Improper use of form height and stand form factors.

The per cent of error from these sources varies from 1 to 10, usually plus. Minus errors are, however, to be feared in underestimating total heights and log lengths of standing timber. Making diameter classes of 2 cm. (1 inch) gives errors of less than 2 per cent, so that they are negligible in most cases.

To illustrate the calculation of the normal stock three examples are given, two for the selection system and one for the group system. As stated above, Heyer's formula is used. Periodic revisions at ten-year intervals are recommended with local determinations of the actual increment. For the latter purpose sample plots carefully marked to insure accurate remeasurement may be used. Every revision of the plan brings more accurate results. A long transition period is recommended when the stock is abnormal rather than abrupt decreases or increases of the annual budget. The calculations which determine the normal stock are relatively easy with a clear-cutting system, but much more complicated with selection stands. For the latter, division of the stand into three equal age classes should give the following relations:

	Per cent of area
Youngest age classes	17
Middle age classes	48
Oldest age classes	35

It is obvious that the relation between normal stock and normal yield will vary with the length of the rotation and the species. The longer the rotation and the slower growing the species the smaller the per cent of the normal stock which the annual felling budget represents. For example, with fir on average sites the per cent varies from 5.39 for a 60-year rotation to 1.77 for a 120-year rotation. Likewise a 60-year rotation ranges from 5.39 for fir to 3.04 per cent for pine in Saxony.

For clear-cutting systems the calculation of the annual budget is relatively easy. Mantel's formula is the simplest for this purpose, especially since it does not require a knowledge of the length of rotation. But with selection forests the process is more complicated. The author recommends the following procedure.

1. Determine a diameter limit which will insure the removal of only mature trees.

2. Caliper all trees over this diameter limit and calculate their volume. This actual yield should be compared graphically with the ideal yield as given by normal yield tables.

3. Revise the yield at least every ten years. This system has the advantage of conservatism but the frequent revisions prevent deficits or the accumulation of surpluses. Furthermore, and important points in mountain selection forests, the calipering is reduced to a minimum and there are no stem analyses or increment borings to take and figure out.

B. E. F.
K. W. W.

Aus dem Gebiete unserer Forsteinrichtung. Schweizerische Zeitschrift für Forstwesen, March, April/May, June/July, August/September, October/November, December, 1918, pp. 49-55; 79-98; 120-136; 162-76; 195-211; 235-43.

Forest Organization in Switzerland

In connection with the foregoing discussion, it is now possible to record the tentative instructions of the Swiss Federal Forest Inspection for uniform methods of organizing the public (cantonal) forests. So far these are only suggestive.

In the subdivision a rational net of roads is to form the basis. Area as regulator of yield is to give way to volume; the area allotment is with few exceptions to be abandoned. The reliable ascertainment of stock and increment (average, at felling age, and current) is considered of greatest importance and methods are suggested. Careful control by periodic inventory according to volume, assortments, value, divided into main and intermediate yields, is prescribed.

In determining the rotation, the index per cent is to guide, which necessitates investigations into value of stock and yield, but other considerations are not to be neglected.

The regulation of the yield is to be based on a felling place to be checked by periodic felling area and formula. The reference to the felling area as well as certain references to rotation, felling age, seems to the reviewer, Hefti, to smack too much of clearing system. He admits, however, that until more reliable increment data are on hand the use of the area is justified. The formula used is Heyer's, except that the increment is not the average at felling age but the current, and the normal stock calculated by the formula $r \times i \times 0{,}4$ (or for spruce and fir x-0,5), where i is also the current increment.

We hope eventually to brief these valuable, carefully formulated working-plan instructions more fully.

Schweizerische Zeitschrift für Forstwesen, June-July, 1918, p. 145.

UTILIZATION, MARKET, AND TECHNOLOGY

Applied Timber Physics

In a very thoughtful and comprehensive discussion, Percy Groom, Professor of Technology of Woods and Fibres, Imperial College of Science and Technology, covers the whole field of timber physics and their practical value to the timber trade as an argument for wider development of this line of investigation in Great Britain. The paper does not contain anything new and is mainly valuable as a circumspect survey of the field. Special emphasis is laid upon the influence of climate and soil on the mechanical structure and practical value of wood of the same species, which should be considered in afforestation schemes.

Incidentally, it is stated that in 1913 the import of wood into the United States amounted to over $200,000,000, of which one-quarter for hardwoods and manufactures.

A table of per capita wood consumption is given as follows:

	Cubic feet		Cubic feet
United States	260	Germany	36.6
Canada	192	France	24.6
Russia	63	United Kingdom	14
Austria-Hungary	57	Italy	13

In a comparison of work done in timber physics in Germany, United States, and Great Britain, due compliments are particularly paid to Mr. Tieman's development of dry kilns, in which the United States leads the world. Great Britain's contributions on this field are practically *nil*. The author should, however, not have overlooked the Indian Forest Research Institute.

Indian Forester, February, 1919, pp. 84-108.

MISCELLANEOUS

Women as Forest Guards

The emancipation of woman in France took another step forward as the result of a court decision of October 18, 1918, sustaining the right of women to employment as forest guards. The question arose through the desire of a private owner to give a permanent appointment to the widow of a forest guard who had been killed in the war, and whose place had been temporarily filled by his wife during his absence. After some delay, the court decided that there was nothing in the Code forestier or any other law which prevented a private owner from appointing a woman for work of this sort, and that the court must accept the oath of office of a woman appointed in this way and agreed to by the prefect or subprefect, provided there are no other legal objections to the appointment. This decision, which is regarded as very important under present conditions, is considered to have been influenced in large part by the fact that women had been similarly employed during the war in other occupations, as for example, on the Paris street railways.

S. T. D.

Jurisprudence. Guyot, Ch. Revue des Eaux et Forêts. Vol. 57, pp. 4-5. January, 1919.

EDITORAL COMMENT

Private Forestry

At least once a month every forester, every lumberman, and every editor of a lumberman's magazine should re-read the message of the President of our Society printed in the March issue of the Journal to put him in a right frame of mind.

If language can goad to action, Mr. Olmsted's vigorous arraignment of the lumbermen should go a long way to arouse them, and foresters as well. Hitherto, it was considered a sin on the part of foresters to antagonize the lumbermen, who must be "persuaded" gently to do better; such denunciatory language as Mr. Olmsted uses would have been tactically unwise. Now, however, having failed with gentility, we may bring up stronger hints of what we think, and even repeat approvingly such choice bits as the following:

"The lumberman refuses to look upon his industry from a viewpoint extending beyond his immediate, individualistic interests, and in stupidly keeping to this narrow outlook he is injuring himself as well as the public. He is killing his forests. . . . The lumbermen of this country have proved themselves incapable of managing their own business interests, to say nothing of the interests of the public. . . . Among the definitions of the verb 'lumber' are the following: 'to heap in disorder,' 'to move cumbrously along,' 'to advance with a rumbling noise.' Regardless of the origin of these definitions, they are fairly descriptive of the lumber industry of the United States. It is cumbrous and disorderly, and for many years past has made a great to-do about advancing, without advancing. . . . The industry as a whole is archaic, individually self-centered, and penny-wise. If lumbermen are ever permitted to combine in restraint of trade, the United States Government should be the undisputed and ever-active boss of the industry so combined, and perhaps the simplest way for the Government to make sure of its control would be to own the bulk of the raw material, the timber. . . . The humor of the situation is that the lumber industry has fallen to its present level because of a total lack of theory and ideals. The time for persuasion has passed."

We hope that Mr. Olmsted's committee of foresters will be as vigorous in constructive direction, formulating a national forest policy.

In this connection, we may also recall the suggestions made by Mr. Graves in the present year's February issue, and the writer's own suggestion in the February issue of last year, regarding co-operation of States, Federal Government, and private owners.

WHY DO WE NEED MORE FOREST RESEARCH?

One of the biggest economic problems before the United States is the production of wood to meet the future needs of our growing population and industries. No one at all familiar with present conditions can doubt that a very serious shortage of timber, with attendant high prices, hardship for consumers, and hindrance to the economic development of the country, will be upon us within a very few years unless vigorous action is taken immediately to insure continuous forest production on forest lands.

A movement, which has already a large measure of popular support, is under way to bring about this continuous production, not only from the public forests, but also on the much greater area of privately owned forest land. But it must be borne in mind that the unanimous support of the public, of the law-making bodies, and of the forest owners themselves will not suffice to insure the production of the right material in quantities sufficient to meet our future needs. Forest protection, conservative cutting, reforestation, restriction of cut to annual growth, will result in continuous crops of some kind of timber, but if undertaken in a haphazard way will not result in continuous crops large enough to meet even our present needs; nor is it at all certain that we shall have either the sizes, grades, or even the species of lumber which will be needed.

When good land is cheap, production and transportation costs low or nil, population sparse, there is little need for study of methods to increase food production, or of selection of varieties to plant. The Indian in the tropics, who has only to go out and gather food which grew without any effort on his part, has no need to indulge in agricultural research. But with a highly developed civilization, with its ever-increasing population and resultant decrease in per capita area of agricultural soil, with increasing costs of production, and with the necessity of carrying the products of the soil long distances to the consumer, it becomes imperative to investigate methods by which a maximum amount of food can be produced, at the lowest practicable cost, on soils best adapted for each particular kind of crop. It is also necessary that the production of different kinds of foods bear some relation to the requirements of the consumers for the various products.

It would not do to devote all agricultural land to the raising of cereals, for instance, even if it should be found that the maximum number of calories of food could be produced by doing so.

In forestry the same rule holds. The "timber-miner," who only harvests what Nature produced, and cares nothing for the future, has no use for forest research. But for a growing nation, whose forests under present methods are producing but a fraction of its needs, and even under the best methods that can be applied with our present knowledge will produce little more than enough for merely present needs, such research is of fundamental importance.

Foresters have yet barely scratched the surface in the study of American forests. It is not enough to know that certain methods of cutting in the Southern Appalachians, for instance, will be followed by reproduction, and that such reproduction will grow rapidly and produce valuable timber. It is necessary to know what method will produce the most valuable timber, or the timber which will best meet the national needs and at the most reasonable cost; it is necessary to know just what species or mixture of species will succeed best under each given set of conditions; it is necessary to be able to say definitely in advance just what will be the yield of a given species managed in a given way on a specific tract of land, and what it will cost to produce it.

From the standpoint of the private owner it will not be enough to say that by adopting such and such a method he will make a profit; he wants to know how he can get the *largest possible* return from his investment in land, labor, and money. From the standpoint of the nation, it is not enough to know that certain methods will result in continuous forest production on forest soils; it is necessary to know which of several methods will best accomplish this result, and what methods will insure the proper proportion of different sizes, and of different grades of material, and of different species.

We have reached a turning point in the development of forestry in this country. There are ample social, economic, production, and growth data to clearly show the need for a change in our methods of handling our timber lands. No further data are necessary to prove to any intelligent observer of our forest conditions that unless our cut-over lands, unsuited for agriculture, are turned back into forest production, we shall in the near future be at a serious economic disadvantage.

Foresters have a sufficiently well-worked-out plan for remedial legislation and enough of basic knowledge for formulating some simple silvicultural procedure by which to maintain continuous production in each forest region. But even as it is, if the forestry profession were

confronted tomorrow with the responsibility for drawing up a plan of management for all the forest lands of the United States, it would be put to a severe test, just as was the case at the time of the placing of the National Forests under forest management.

The Forest Service found it necessary to establish eight or nine experiment stations to solve the technical problems that immediately arose in marking timber, in working out methods of brush disposal, methods to secure natural reproduction, methods of artificial reforestation, and similar problems. If the profession, therefore, is not to be content with merely securing some kind of growth on cut-over land, no matter how inferior it may be as compared with the original stand, but desires to be able to secure forest growth of the highest economic utility, it must set itself at once to the task of securing more fundamental facts upon which to base its practice on the vast area of privately owned timber land.

The only way in which such data can be obtained is by long-continued, painstaking, scientific research. They cannot be obtained in a year or in a few years, as in the case of agricultural investigations, which deal with annual or biennial crops, but require long periods.

Is it not time that such research be started on a very much larger scale than has been undertaken hitherto, in order that when the mandate comes we foresters shall not be found lacking?

Where the Lumbermen Stand

The first American Lumber Congress, which met at Chicago from April 14 to 16, is unanimously described by the lumber-trade journals as the most important meeting of lumbermen that ever occurred in the United States. Because of the large attendance of representatives from all branches of the lumber industry, its deliberations may fairly be regarded as indicating the present state of mind of the lumbermen of the country.

From the standpoint of those interested in the conservation of our forest resources, the most noteworthy feature of the conference was its very evident apathy as to the future supply of the raw material on which the entire lumber industry is based. It is a significant fact that of the thirty-odd speakers the only two who alluded, even indirectly, to this vital problem were representatives of the Federal Government. These were H. S. Graves, of the U. S. Forest Service, and W. S. Culbertson, of the U. S. Tariff Commission. Mr. Graves' speech, which was printed in full in the April issue of the JOURNAL, was a clear-cut

presentation of the absolute necessity for the practice of forestry on private lands and a direct call to action. Mr. Culbertson's allusion to forestry was briefer, but along somewhat the same lines. While expressing the belief that a sound lumber export policy is a national asset and not inconsistent with the interests of American consumers and the conservation of our natural resources, he called attention to the fact that we cannot have a permanent export policy which does not include plans for stabilizing domestic production and conserving our natural resources. He pointed out very pertinently that the continued existence of an export trade in lumber—and for that matter the very existence of the lumber industry itself—depends on the maintenance of our forest resources.

These warnings that the lumber industry must be stabilized by the practice of forestry do not seem to have evoked so much as a ripple of interest. The Congress listened politely, applauded politely, and promptly proceeded with its discussion of ways and means to sell more lumber. It is a remarkable fact that to all appearances those present had no interest whatever in the future of their industry.

The need for stimulating sales by convincing the public that no reduction in the present low prices can be expected came in for considerable attention. The Sherman anti-trust law received the customary attack. The organization under Government sanction of a combination of lumber-selling agencies was advocated as a means of insuring the receipt of prices based on cost and reasonable return on the investment, and not on the figure at which purchases could be made under unrestrained competition on the part of the selling agencies.

Members of the Congress were strongly urged to support the home-building campaign inaugurated by the Department of Labor as an effective means of selling more lumber. The "Own your own home" and "Build now" slogans met with special favor. One speaker pointed out that the lumber industry is now in the fortunate position of finding its business being made a patriotic issue by the Government—a support enjoyed by no other industry. Those attending the Congress were advised by J. R. Moorehead, Secretary-Manager of the Southwestern Lumbermen's Association, to push the establishment of building and loan associations by each State for every community within its boundaries as a means of promoting construction. Mr. Moorehead made it plain, however, that his advocacy of home-building was not prompted entirely by mercenary motives. He placed the matter on a much higher plane and pointed out that a moral obligation rested upon the lumbermen of the country to assist those less fortunate than themselves to

obtain those things necessary to a well-balanced life. In his judgment, the possibilities, from a social, moral, and economic standpoint, of establishing every family in its own home cannot be estimated. To quote his own words: "Our safety in the future is in the planting of our nomadic population in a home along by the side of its job."

J. H. Kirby, President of the National Lumber Manufacturers' Association, went Mr. Moorehead one better in the way of patriotism and morality. In an eloquent speech, he recalled to the minds of the lumbermen the Declaration of Independence, the inalienable rights of men, and the sanctity of human happiness as the object of human life. "That happiness cannot be secured should we ever become a nation of tenants. It is the home where there are peace and love and contentment and sweetness. It is the home that is the citadel of patriotism. It is the home that inspires man with all those lofty things that will make him want to die, if necessary, for his country; give up life, if necessary, for the promotion of happiness of others."

It would be interesting to know how far the lumbermen are planning to apply the ideal of home-building and home-owning in their own industry. In times past it has been notorious that the majority of lumber companies have taken every precaution to prevent this very thing. It has been the almost invariable rule that the companies have preferred to own both the land and the houses where their employees live, because of the greater control which this gives them over the employees. "Home" is also a rather dignified title for many of the shacks erected for this purpose.

Furthermore, the industry as a whole has done everything in its power to prevent even these rude dwellings from becoming permanent by the way in which it has handled the forest resources of the country. If Mr. Moorehead is right in his dictum, that "our safety in the future is in the planting of our nomadic population in a home along by the side of its job," the lumber industry has certainly done its full share to make the future unsafe, so far as the population to which it gives employment is concerned. Deserted villages and abandoned farms are all too common a sight in the regions through which the lumber industry has swept with no thought for the future.

Charles Keith, of Kansas City, a Director of the National Lumber Manufacturers' Association, made a vigorous appeal for the maintenance of high lumber prices and the establishment of industrial combinations as a means not only of assisting the lumber industry, but of saving the country from the dangers of bolshevism, socialism, and anarchy. He expressed alarm at the drift of the world toward mate-

rialistic things and away from spiritual thought. He deplored the loss of the influence of the church over the masses of the people and pointed out that the development of socialism can only spell sin, misery, and ruin. In the absence of organized effort on the part of such men as those of the Congress, he felt that we would be quite helpless and without means to divert the dangers of the situation. He therefore urged the lumbermen to prove their spirituality and to do their duty as American citizens and Christian gentlemen by organized effort along the following lines:

To seek a modification of the Sherman Act, so as to permit reasonable combinations in trade under proper supervision, and to organize the lumber industry under the Webb-Pomerene Act, so as not to be in competition with the producers of the North American Continent, but with the rest of the world.

To seek a revision of the shipping laws to permit the American flag to fly at the mastheads of privately owned American ships in competition with the shipowners of other nations; and to seek the speedy return of the railroads to their owners under pre-war conditions, unrestrained by restrictive laws.

To study closely and analyze carefully the condition of the industry and give publicity thereto. The public should be informed that, while the personal touch between employer and employee is gone, a real bond of human sympathy does exist. This bond should be strengthened and industrial strife lessened.

To support the agencies of Christianity in the promulgation of the faith, thus aiding in diverting human unrest into its proper channels.

The resolutions adopted by the Congress are similarly devoid of any reference whatever to the productive end of the lumber industry. It is, perhaps, too much to expect an unequivocal declaration from the industry in favor of the practice of forestry on private lands. It does not seem unreasonable, however, to expect the industry to recognize the fact that the perpetuation of the raw material on which its very existence depends is of some importance. Perhaps we might even, without being unreasonable, have looked for at least an expression of willingness to co-operate with the Federal Government along the lines outlined by Mr. Graves. Perhaps, however, we are misjudging the Congress in our interpretation of its attitude. If silence gives consent, the lumber industry can certainly be regarded as thoroughly in favor of radical action along the lines suggested by Mr. Graves and Mr. Culbertson to perpetuate our timber supply.

The sessions of the American Lumber Congress were followed by

the annual business meeting of the National Lumber Manufacturers' Association. The most interesting features of this were the reports by Dr. Wilson Compton, Secretary-Manager of the Association, by R. B. Goodman, head of the recently established Bureau of Economics, and by Gen. L. C. Boyle, counsel for the association.

Dr. Compton's comprehensive report reviews in detail the activities of the association during the past year and is worth reading *in toto* by those who are interested in knowing just what the association is doing. The objects of the association are formulated in a creed consisting of nine articles, which are summarized by Dr. Compton in the single phrase: "To represent the common interest of the lumber industry in national affairs." In many respects both the creed and the report as a whole are more interesting because of their omissions than because of their contents. It is disappointing, as well as surprising, that Dr. Compton, whose experience in the Bureau of Corporations and the Federal Trade Commission should have given him a thorough knowledge of the weakness of the lumber industry from the productive end, should have seen fit to ignore this end entirely in his report. In spite of his silence, one cannot believe that he is ignorant of the importance of such fundamental problems as fire protection, methods of maintaining forest productivity, classification of forest lands, relations between employer and employee, establishment of permanent forest communities, etc.

The new Bureau of Lumber Economics, established at the request of the Commissioner of Internal Revenue, is now collecting and sending each week to members of subscribing associations the most complete obtainable statement of the current production and movement of lumber, the volume of orders received, the relation of current supply to current demand, and the relation of all to the normal. In addition, it has just started to issue a monthly graphic chart of lumber movement and a special comparative graphic summary showing the change from month to month in fundamental business conditions and in immediate business prospects. Activities of this sort should be most helpful in giving the lumbermen of the country the basic facts regarding the volume and movement of their business. The Bureau also plans, at the request of the Commissioner of Internal Revenue, to secure the basic economic information concerning costs, prices, and values of timber properties, wastage of assets, depreciation of improvements, volume of reserves of stumpage, and the methods of valuation of timber properties which are necessary to the wise and fair administration of the laws.

Considerable attention was paid by Dr. Compton and Gen. Boyle to the tax situation under the new revenue law. Gen. Boyle pointed out that the efforts of the association had saved three million dollars to the industry by securing the amendment of the bill as it came from the House so as to provide for depreciation or depletion as applied to the lumber industry. Previously, the depreciation had been based on waste and wear, while now lumbermen will be privileged to depreciate their mill plant currently as the stumpage diminishes, so that at the end of the cut the mill capital will have been returned to the investment. In other words, the mill plant is regarded as becoming worthless when the timber tributary to it has been exhausted, irrespective of the way in which the timber has been cut. This means that the lumber industry has, in effect, secured legal recognition of the fact that the forest is a mine and not a crop; for, if the forest is treated as a crop, it is possible to keep the land continuously productive, and by proper regulation of the cut to continue lumbering and milling operations indefinitely. The same principle as applied to standing timber means that the investment is reduced to zero by the time the last stumpage is cut; while, if forestry were practiced, the constant renewal of the forest would mean the maintenance indefinitely of a considerable part, at least, of the original investment. The present wording of the law is unquestionably a victory for the lumbermen, who have consistently maintained, through the utterances of their counsel and others, that timber is an exhaustible resource which can be harvested but once. Are foresters willing to let this view stand unchallenged?

The association was unsuccessful in its effort to secure amendment of the provision that the valuation of forest properties must be based on their purchase price and not on their market value on March 1, 1913. They were, however, successful in securing the insertion of a so-called "relief section," giving discretion to the Commissioner of Internal Revenue to modify the application of this provision where peculiar conditions exist in any industry, so as to prevent it from bearing an excessive or disproportionate burden. This is regarded as accomplishing substantially the end sought by representatives of the industry, since they appear to have no question but that they can establish the right of the present owners to the unearned increment that has accrued in the value of the timber since its acquisition. As Dr. Compton puts it: "If the lumber industry will make it possible for the National Association to place the basic economic facts of the industry in the hands of the Treasury Department, intelligent and equitable administration of the revenue law may be confidently expected."

Several facts appear to have been rather definitely established by the two meetings in Chicago:

(1) The lumber industry does not regard its investment in timber as permanent, and is therefore anxious to convert its timber holdings into cash as soon as possible and at the highest possible profit.

(2) It has decided to wage an energetic advertising campaign, altruistically laying particular stress on the "Own your own home" movement as one of the most effective means of increasing lumber sales.

(3) Every effort will be made to have the investment in both stumpage and equipment valued and taxed on the basis that the forest is a mine and not a crop.

(4) Those interested in safeguarding the future of our timber supply cannot look to the lumbermen for any concerted support in the effort to make the practice of forestry general on private as well as public lands.

Why a Union for Foresters?

As a forester and a member of the National Federation of Federal Employees, I should like to make some remarks on the Journal's editorial comment in the April issue on the subject, "Why Not a Union for Foresters"?

Full consideration of the big and vital question brought forward by Aldo Leopold and by the editorial commentary on his article, so far as they relate to unionism, would involve a lengthy discussion of the whole trend and purpose of the labor movement.

I am heartily in favor of the unionization of professional men, and fully believe that the "brain-workers" of America will, in the next two decades, be fully organized as joint partners in the great labor movement that has been carried forward during the past century by the hand-workers. Their interests are joint interests; but through innate conservatism, false pride, "white-collar" snobbishness, lethargy, and economic stupidity the professional classes have always dreamed that their real interests lie with the capitalist class. The truth is that the technical workers have always been the keen-edged tools that, in combination with the hand-workers, have been used for the creation of wealth which has, in great part, been appropriated by non-producers. Their economic status has been regulated by the law of pure, unrestrained competition, and this status is bound to become worse and worse as competition becomes more keen by reason of the increase of technical schools, the cheapening of technical education, and the in-

crease in the prices of all commodities that results from the constant growth of the share of labor in directing and reaping the rewards of production.

It is obvious, then, that technical workers, unless they are to suffer from an ever-increasing pauperism, must acquire the elementary intelligence to defend themselves. In a world whose population is measured by billions, it is clearly idle to imagine that there remains such a thing as individual protection. Organization, mass movement, is the only feasible means of defense.

If you follow the old trade union or craft principle of organization, splitting up the professions, you immediately create a huge waste of energy in duplication of effort and organization. Nation-wide propaganda is a difficult and costly undertaking. What is needed is a National Federation of Technical Workers, which will include every scientific worker of sufficient attainment to be ranked as a technician in his line.

There are certain dangers in attempting to create a union of foresters. If it is done through the Society of American Foresters, there is the danger of a split in that organization. As a class, professional men are conservative, and many of them would prefer respectable starvation to breaking bread with the American Federation of Labor. Moreover, the establishment of a union of foresters may withdraw from the Federation of Federal Employees a considerable number of Government foresters who are able to wield a potent influence in that organization.

Whatever principle of organization is adopted, it ought to proceed on the basic truth that the interests of all workers are identical, namely, to secure a just share in the process of production-management, to have a voice in regulating the conditions of employment, and to obtain a fair share of the product. Why not let the Society of American Foresters be one of the pioneers in this work? Why not draw up a program for technical workers, irrespective of their profession, creed, or condition of servitude, and lay it before every scientific association of America? If the time was ever ripe for such a move, that time is now.

In the meantime let every Government forester roll up his sleeves and get into the Federation of Federal Employees. That organization offers an immediate opportunity for work that is vital to the full success of the Federal forest policy. There is need in the Federation for more professional men. Recognizing that need, Government scientists, several hundred strong, ranging from chemists and physicists to pa-

thologists and bacteriologists, have gone over in a body to the Federation. It is time for foresters to forget their traditional prejudices and to get into the greatest and most vital movement in the world—the labor movement. It is a movement that, in its promise of a decent future for humanity, transcends every question of profession, politics, religion, or race. In truth, it embraces all these; and it needs every ounce of intellectual and moral force of every worker to guide it in a straight path. It is not a mere privilege for a worker to become a part of this great force. It is his duty to himself, to his profession, to his country, and to mankind at large to contribute his share toward alleviating the crass brutalities of modern industrial civilization.

W. S.

Reconstruction and Natural Resources

Although between the writing and the reading of this comment some little time will have passed and the propositions may in part have taken practical form, we think it still not too late to call attention to an article in the *Journal of Political Economy* for April on "Reconstruction and Natural Resources," by Raphael Zon.

The article, analyzing the problem of reinstating the returned soldiers in industrial and social life, is so sane and convincing that it is to be hoped that its recommendations will find recognition by authorities and agencies having this work in hand. The subject is treated in a broad-gauged way, with a comprehensive plan not of immediate ephemeral, but future permanent results.

"Let the reward be in the form of a real chance to work and develop his ambitions, not a mere bounty that may be quickly spent."

Four methods are open to the nation, namely:

1. Opportunity for settling on the land.

2. Employment in the development of the natural resources, such as forests, mines, water-power, oil fields, etc.

3. Combined urban and rural occupation.

4. Reserve employment. Construction of public works for improving country life, such as railroads, roads, rural building construction, draining swamp lands, reclamation of arid lands, etc.

As regards the first method, a few sentences will make clear the author's attitude. "The time has come to abandon the policy of placing people carelessly on poor land and to substitute by proper organization and careful planning the development of the millions of acres of good land now idle and to secure permanent homes, continuous production, and sound social and industrial conditions. . . . Free land

alone is not enough. . . . The results of the efforts to settle poor and unfit lands under the Homestead and Desert Land Act are written in the tragic failures of thousands of pioneers who wasted their efforts, lost their hopes, and became impoverished and embittered." He then cites definite cases of abandoned farms. "Rural community development is at the root of a country's progress," citing such community settlements from California, Australia, New Zealand, and France, and developing the proper fifteen principles in such settlements.

In the discussion of the employment in developing other than agricultural resources, what is said about the opportunities which the forest resources offer for developing permanent and contented communities interests us, naturally, most. We quote: "The lumber industry as it is at present constituted offers small opportunity for permanent and contented communities. . . . Timber-mining, being essentially migratory, breeds migratory tramp labor. Since the lumberjack must live in a camp and the man with a family is excluded as a worker, the lumber industry is an industry of homeless men. . . . With migratory forest industry it is financially impossible to construct residences for workers, because the annual depreciation charges of 25 per cent or more would be far beyond the ability of the worker to pay from wages. . . . These unsatisfactory conditions in the industry can be rectified by transforming it from an industry which uses the forest as a mine to one which treats it as a renewable resource. Such a transformation is difficult on private lands. A few private owners may be found now ready to change their method of handling their timber resources and thus provide opportunities for permanent communities. As a rule, however, such a transformation will not take place without the people first securing control of the large timber holdings. For the purpose of providing for the returning soldier we must therefore look to the National Forests. These afford immediate opportunities for creating permanent forest communities in connection with logging operations on them. Assuming that only two-thirds of the forest area within the National Forests, or 100 million acres, is actually forest-bearing land, this area, when fully developed, could, at a conservative estimate, support a permanent population of 300,000 families, allowing each family $800 a year in wages, or about 1,200,000 persons in all." This position is supported by citing such forest communities from Switzerland and France (the Landes).

"The task of organizing our National Forests into small units on a strictly continuous-yield basis is not as difficult as it may seem and is not beyond the strength of the existing organization in the Forest

Service. It does not mean tackling the regulation of 100,000,000 acres of forest at once, but organizing here an area and there an area as the ever-widening circles of economic life come into contact with them. Intensive forest surveys are ahead of rather than behind present needs. The objection that the National Forests do not always control sufficiently large units for sustained management should not present an insurmountable obstacle, because co-operation of the public and private owners in the management of natural producing units can be secured in most cases on a basis satisfactory to both. . . .

"The basis for each forest community would be the area within whose radius an annual cut may be permanently maintained. A sawmill suitably located within the area and continuously supplied with timber from the growth on land tributary to it would form the basis of a sawmill community which could remain permanently in one location. The logging camps which may have to change from time to time would still form a part of the entire forest community organization. The lumberjacks who are now in France engaged in logging and milling operations on government and private forests would be admirably fitted for similar logging operations on the National Forests. Possibly a great deal of the logging equipment which is the property of the United States Government may be available upon the termination of the war for this purpose.

"The shortage of pulp and paper in this country and the presence of a large supply of pulp timber available on the National Forests opens another way for meeting the unemployment problem. The pulp industry, more than the sawmill town, provides opportunities for creating large village communities with healthful social life.

"The utilization of the immense water powers on the public domain, and particularly on the National Forests, possess wonderful possibilities for creating new towns and rural industries, such, for instance, as the pulp and paper industry and the electrification of large stretches of the publicly controlled railroads. The same is true with regard to the mining resources on the public domain, particularly in Alaska."

Will it be possible to carry out such ambitious schemes as rapidly as the needs of settling the returned soldiers demand? These needs are immediate, while the proposed schemes require time. The suggestion of community settlement does not, however, for that reason lose its value and should be followed up with all vigor.

B. E. F.

NOTES

An Example of Private Forestry in the Adirondacks

In the spring of 1910, Finch, Pruyn & Company, operating lumber, pulp, and paper mills at Glens Falls, on the Hudson River, N. Y., decided to employ a technically trained forester. Their holdings in the Adirondacks comprised roughly 150,000 acres on the Hudson, Schroon, Cedar, Boreas, and Sacandaga Rivers, about 20,000 acres being first-growth spruce, hemlock, and pine, and the balance second-growth softwoods and large hardwoods. Austin Cary, of the U. S. Forest Service, who was at that time Superintendent of Forests for New York State, was instrumental in deciding on the choice of a forester.

A talk with the management made it clear that what they considered essential was a valuation survey of the entire holdings, from which would result:

(1) A system of maps showing timber and topography on a reasonably large and entirely uniform scale.

(2) A written report giving detailed and accurate information concerning merchantable and young timber on each watershed area or logging unit.

(3) Stand and yield tables for each commercial species.

(4) Recommendations for logging operations.

The timber sheets were to show the location and acreage of virgin forest, cuts, burns and windfalls, with dates, and description of remaining growth; also placing all trails, dams, camps, and telephone lines. These maps were to be kept constantly up to date and, with the stand and yield tables, furnish a correct and classified inventory of raw material.

In order to supply the mills, it was deemed necessary to cut about 20,000,000 feet board measure annually, besides some logs purchased and wood shipped in from Canada.

Two years were spent in surveying and mapping the lands, working up the data on stand and growth, and getting the working plans ready for use. The United States Geological Survey quadrangles served as the basis for topographic maps, but were enlarged to a scale of four inches to the mile.

It was, and is, the policy of this corporation to consider forestry

solely as a business proposition. Forestry work has been practically free from friction with the other departments and the forester has been able to carry out most of the plans made by constantly working for results that were practical under the conditions existing on each area being logged and disregarding many points which, for the immediate good of the forest, he would have liked to put through, but which experience warned would be financially impracticable.

Nearly the entire holdings of this corporation are rolling or mountainous and are so far from railroads that cutting hardwoods has not been attempted, as all logs must be floated down river to the mills. It is hoped that soon some means for logging the old growth maple and birch may be worked out, as there is a very large quantity on the lower slopes of the mountains which prevents handling the spruce to the best silvicultural advantage and hinders new growth of all spruce.

In general, the method of controlling the cutting has been to mark all trees to be taken and to inspect the area after the logs are cut and removed. No fixed diameter limit has been used, but an attempt has been made to leave a sufficient number of the younger and smaller trees for a profitable future cut and, at the same time, not materially to increase the present logging costs, which are on many areas, at best, almost prohibitive. The cutting has taken spruce, balsam, and hemlock to something like 10 inches d. b. h., on an average, on the lower ground, 12 inches d. b. h. on the spruce and hardwood land, and either everything or nothing on the exposed upper slopes.

About one-third of the forester's time has been devoted to the study of costs and to making tests in the woods and at the mills. Some time is spent on each logging job each season making time studies and determining costs of felling, bucking, skidding, drawing, road-building, etc.

A very large number of measurements have been made to determine average taper for various species and sizes of logs, percentage of bark, both of measure and weight, and the amount of shrinkage in weight and measure due to seasoning in the woods. These figures are of value in determining the cost of handling material and especially in how much rough green stock in the woods will yield a certain amount of seasoned, peeled wood at the mill. A considerable number of tests have also been made at the mills to determine the product and the relative costs and values for various log sizes. Total cost and value figures are essential in determining what log sizes can profitably be taken from the woods.

Considerable money is spent each year for fire protection—experienced men patrol the woodlands during the dry season, and tele-

phones and fire-fighting tools are kept at all camps. There have been no fires of consequence since 1909. Last season work was begun in co-operation with the N. Y. Section of the Society of American Foresters and the Forestry Department at Cornell University in establishing permanent sample plots on the various forest types and where various methods of lumbering had been used, to obtain accurate records for the future. More of these plots are to be laid out this year.

Naturally, some mistakes have been made, but it is hoped they are not repeated and that methods of operating will improve as rapidly as conditions will permit.

H. L. CHURCHILL.

PUBLIC CONTROL OF FOREST DWELLINGS IN NORWAY

Those who have complained of the living accommodations sometimes provided for forest workers in the United States will be interested in the action taken by Norway to insure the erection, by private owners, of sanitary and comfortable dwellings.

On July 30, 1915, Norway adopted a law intended to regulate the construction and equipment of buildings used in connection with work in the forests and river driving. This law was brought to the attention of the governing bodies of the various districts (herreder) by a circular letter of October 30, 1915, from the Agricultural Department to the county prefects, calling upon them for the adoption of the regulations contemplated by the law in all districts where cutting, lumbering, and driving operations were ordinarily conducted to any considerable extent, and in connection with which the people and horses employed had to stay over night in the forest. The letter was also accompanied by the following suggestions as to suitable regulations which had been prepared by the Director of the Forest Service:

(1) Every house which is to be used as a dwelling for workers in connection with forest and driving operations during the period from October 1 to May 15 shall be:

(*a*) Built on a dry site with easy access to water.

(*b*) Erected on a foundation of stone or provided with a bank of turf or earth around the outer walls.

(*c*) Provided with tight walls, roof, doors, and windows, with shelves, sleeping bunks raised at least 40 centimeters (16 inches) from the floor, a cookstove, either alone or connected with the chimney, first-aid materials, and a cupboard for the storing of provisions.

(*d*) Equipped with the necessary ventilation.

(2) Every house or shed which is used as a stable in logging operations during the period from October 1 to May 15 shall be:

(*a*) Built on a dry site.

(*b*) Erected on a foundation of stone or provided with a bank of turf or earth around the outer walls.

(*c*) Provided with tight walls, roof, doors, and windows, and stalls with wooden floors. The stalls shall be at least 1½ meters (5 feet) wide and 2½ meters (8.2 feet) long, including the manger.

(3) According to instructions from the Board of Health, the forest owner is required to erect such buildings as specified in paragraphs 1 and 2 before cutting for sale or industrial use is undertaken, or within a period of grace fixed by the Board of Health and reckoned from the beginning of the cutting.

(4) A copy of these regulations shall be posted in a conspicuous place in every such building as specified in paragraphs 1 and 2.

The letter was also accompanied by designs for forest houses of various sizes, some of them in connection with stables.

No regulations under the new law were approved during 1915. In 1916, however, regulations were approved for 30 districts. In view of the fact that there are some 550 forested districts in Norway, it is evident that action by many other districts is necessary before compliance with the law becomes at all general.

While the regulations proposed are by no means drastic, they do insure the erection of at least livable dwellings for forest workers and are of particular interest as indicating the constantly increasing scope of public control in forest affairs.

S. T. D.

Public Control of Water Power in Norway

In 1909 Norway adopted an effective law to prevent its natural resources from passing largely into the hands of foreigners and to safeguard the interests of the people as a whole in these resources. Under this law the purchase and sale of waterfalls and rapids representing less than 1,000 horsepower are unrestricted, but the right to use larger falls must be secured by "concession," or permission granted by the king. These concessions carry with them rather rigid conditions. Citizens must be allowed to become partners in the undertaking for which the concession is granted and conditions may be established preventing persons who use another waterfall, or who own a majority of shares in another company, from securing a majority

of shares in the new undertaking. The district in which the concession is located is granted at a moderate price for public use, 5 per cent of the power developed, and the State receives 5 per cent under the same conditions. The most important condition is the limitation of the period for which the concession is granted to not less than 60 years and not more than 80 years. After this period the waterfalls, dams, water mains, pipes, etc., all become the property of the State without compensation.

In regard to mining, the law provides that prospecting and trial operation may be carried on without concession, but the right to mine must be secured through concession. This imposes several conditions, including the right of the Government to impose a tax of 3 per cent on the output of the mine. Furthermore, the concession is granted only for a fixed period not exceeding 80 years, after which the ownership of the property, together with the machinery and improvements, reverts to the Government without compensation.

So far as forests are concerned, foreigners are not allowed to acquire any property without concession. Citizens and Norwegian stock companies may buy timber areas not exceeding 250 acres. From 250 to 1,250 acres may be bought by Norwegian citizens, or local communities, with the restriction that they must not own over one-tenth of the total timber area of the district, and the community has the right of pre-emption in all such purchases. In addition, special laws have been enacted regulating the cutting of protection forest and other forests.

This law, and especially the feature that relates to the reversion to the State of mines and water powers, was attacked by conservatives as being socialistic and unconstitutional, and as retarding progress by keeping foreign capital out of the country. Those favoring the law, however, preferred to insure to the people of Norway as a whole full control over their natural resources, even if progress should be rendered somewhat slower thereby. As a matter of fact, rapid industrial progress is being made under the law and the feeling that the new industries really belong to the whole people has created a confidence and optimism that will insure the healthy development of the resources of the country.

S. T. D.

The Cascara Bark Industry on the Siuslaw National Forest

The peeling of cascara bark (*Rhamnus purshiana*) has for many years been one of the local industries of the homesteaders in the

narrow valleys of the Coast Range of Oregon. Here this little understory tree, rarely over 12 inches in diameter and 60 feet high, reaches its prime and becomes a conspicuous member of the forest on the moister bottoms and benches, where the shade of Douglas fir is not too dense. From this region comes the majority of the world's supply of this highly prized medicinal bark.

The gathering of "chittim bark," as it is called locally, is distinctly a home industry. The tools are an ax, a hand-made spud, and a few gunny sacks. The work is done by the settler alone or with the help of his children during the spring months, when the bark will slip. The trees are first felled, then peeled, even to the smaller limbs; the bark is allowed to dry a day or two and is then tied into bundles, like wall paper, and back-packed to the nearest road or trail, whence it can be loaded on a horse or wagon and taken to the settler's shed, to be further dried, cleaned of moss, broken up fine, and sacked. It is rare for a single tree to yield as much as 100 pounds of dry bark, though yields of 250 pounds do occur. The bark shrinks about one-half in drying.

At the local store it is sold or bartered for necessary staples or wares. To many Coast Range settlers it is their chief source of ready cash during the first years of land clearing. The price paid peelers for dry bark has recently ranged from 6 cents per pound to about 13 cents, and there is a resultant activity in the industry. The price fluctuates widely because of inevitable over-production at each marked increase in price and a subsequent cessation of production when the price is low.

The best tracts of accessible cascara bark stumpage, both on private land and on the Siuslaw National Forest, have been cut and it is necessary now for peelers to go farther back into the hills and away from trails.

Recently a tract of 20,000 pounds of rather inaccessible bark on the Siuslaw was advertised for sale—the first tract of National Forest cascara bark to be advertised, so far as known. Five bids were received, with the result that the price was run up from 3 cents, as advertised, to 5.1 cents a pound for dry bark.

On the Siuslaw some of the rangers are kept busy in the spring and summer looking after sales of cascara bark stumpage. Most of the transactions are for a few dollars' worth only, though about 100,000 pounds were sold on that Forest last year, and over half of that in Ranger McCaskie's district alone.

While the accessible and well-stocked stands of good-sized trees

are getting scarce, there is enough of the virgin supply of this tree in western Oregon and Washington to meet the world's needs for this medicine for many years to come. However, the necessity to peel from smaller, more inaccessible and more scattered trees, will tend to raise the value of the product. The fact that much of the optimum habitat of this species is agricultural land and is being so developed, means that some stands will not be reproduced and that there will result an actual diminution of the acreage of ultimate cascara land.

In Forest Service sales of cascara bark stumpage simple requirements are enforced which aim to secure replacement and close utilization of the species. Stumps must be less than 6 inches high, cut smooth, and not peeled, to promote sprouting. Limbs down to 2 inches diameter must be peeled, and the tops lopped. Sprouting of the cut stumps is quite satisfactory, particularly with the earliest spring cuttings. Already some of the old cuttings on private lands are yielding sprouts large enough to peel.

THORNTON T. MUNGER.

A COMMERCIAL AND SILVICAL TREE STUDY OF SITKA SPRUCE BEGUN

The operations of the Spruce Production Division of the War Department in the Sitka spruce belt of the Pacific Coast have furnished an excellent opportunity to study Sitka spruce. Hitherto there has been so little cutting of this minority species that in any one camp it was difficult to get enough trees for measurement. Now there are thousands of acres of freshly cut stumps available for analysis and in places millions of feet of logs bucked and left where felled when the operations were abandoned last fall. A small party of silvical research men from the Oregon and Washington District of the Forest Service has therefore been put in the field to study representative tracts of spruce in the coastal regions of those States, under the direction of Forest Assistant N. L. Cary, who has just been mustered out of the Spruce Production Division.

The amount of scientific information about the species is singularly meager and an almost virgin field is open to investigation. Aside from gathering the conventional data on silvical characteristics, and stand and tree measurements, an effort will be made to assemble and record the information which has resulted from the lumbering activities of the aircraft spruce production campaign.

In the past two years a great deal of cruising has been done by the War Department, and, in connection with the logging and milling

of spruce, much information has been gained about its forest habits and its quality, and about spiral grain, defects, and yield by grades. The aim is to gather these data, from widely scattered and rapidly dissipating sources, and to correlate them in order that they may be of use to foresters and lumbermen.

There has been talk of creating spruce reserves to provide against future industrial needs for aircraft construction. For intelligent action on such a matter a much better understanding of the requirements and characteristics of such stands as might be held for many years is essential. Such questions as the following will be answered by this study: Is Sitka spruce a tree of agricultural or ultimate forest soils? What is the relation between age and quality? What is the life history of its defects? What are its enemies? What are its reactions upon various sites? etc.

THORNTON T. MUNGER.

SPRUCE GUM IN THE NORTHEAST

More than 1,500 tons of crude spruce gum are estimated to be harvested annually in the State of Maine alone. In years gone by spruce gum was harvested by the lumberjacks, who collected the choicest bits in the course of their regular work. But as this class of laborers was supplanted by foreigners, who knew nothing of spruce gum, dealers experienced great difficulty in procuring the gum and so the professional gum gatherer got into the game. Gum is collected throughout the year, although fall and winter is the most popular season. During the summer black flies are a nuisance and the collectors lose much time in fighting them off. Pickers usually work in pairs, mainly for sake of sociability. A small hatchet is used to remove the gum, which is dropped into a small pan or even a hat. Oftentimes the axe is fitted with a hollow handle into which a pole can be fitted, thus enabling the gummers to reach lumps high up and ordinarily beyond reach.

Twenty-five to thirty pounds is considered a fair day's haul. The gatherings are cleaned and sorted. All bark, moss, and other foreign matter is removed from the lumps of gum. The haul is sold under two grades—"lump" and "chip" gum. The lump gum is free from any foreign matter and is usually retailed in the original lump. The chip gum, however, is so mixed with bark, etc., that it must be steamed before retailing. After steaming it is rolled, cut into sticks, and wrapped in tissue paper.

The Lumber Industry in Montana

The importance and growth of the lumber industry in the State of Montana, from its inception in 1864, when the first mill was put into operation, down to the present time, when more than 100 mills are in the State, is set forth in a recent issue of a trade journal.

The first sawmill operated in Montana was located at St. Regis. This was in 1864, and the mill had a rated annual capacity of 50,000. About $1,000 was the capital invested. This mill had the field to itself until the year 1880, when a second mill was started at Jeffers, Montana, with an annual capacity of 90,000 feet. No competitors to these mills appeared for 15 years. Then a mill was erected at Hamilton, with an annual capacity of 115,000 feet and a capital investment of about $300,000. The three mills employed a total of 107 men.

The lumber industry continued its growth, and by 1914 there were 98 mills in operation, with an annual capacity of 532,000,000 feet and a capital investment of more than $15,000,000, and employing 4,500 men.

At present it is stated that there are 105 mills, of which some of the largest have an annual capacity of from 60,000,000 to 80,000,000 feet. In most instances planing mills are operated in conjunction with the sawmill.

With the growth of the sawmill output there has been a corresponding development of the logging industry. The first real logging camp was built at Bonner, and the second at St. Regis. All the latest devices for efficient logging are in use and the logging industry is of the utmost importance.

Special Course of Lectures

The New York State College of Forestry, at Syracuse University, announces a special course of evening lectures by men prominent in forestry, paper and pulp manufacture, and chemistry of forest products.

April 24—Ernst G. Behrend, President, Hammermill Paper Co., Erie, Pa.: "The Development of Paper Making in America."

April 30—James W. Toumey, Director, Forest School, Yale University: "Reconstruction and the Conservation of Natural Resources."

May 7—C. D. Howe, Faculty of Forestry, University of Toronto: "Forest Conditions in Canada."

May 8—Filibert Roth, in Charge Forestry, University of Michigan: "Forestry Education."

May 13—C. P. Winslow, Director, U. S. Forest Products Laboratory, Madison, Wis.: "A Forest Products Laboratory and National Defense."

May 15—R. S. Kellogg, Secretary, News Print Service Bureau, New York City: "The Manufacture of News Print Paper."

May 20—R. S. Hatch, President, Technical Association of Paper and Pulp Industry, Holyoke, Mass.: "Standards in Raw and Finished Products."

May 22—George W. Sisson, Jr., President, American Paper and Pulp Association, Potsdam, N. Y.: "The Manufacture of Wood Pulp Paper in America."

May 27—Jno. S. Bates, Superintendent, Forest Products Laboratory, McGill University: "The Future of the Paper Industry in America."

Wood Fuel in Argentina

The practical shutting off of the importation of coal has led to the creation of a temporary industry of getting fuel from the quebracho tree. This wood cannot compete with coal for fuel in normal times, but it has prevented many industries from closing down during the past three years. It requires about 2½ tons of quebracho wood to give the same amount of heat as 1 ton of coal. This fuel sells locally at about $15.50 a ton.

Millions of tons of native woods have been consumed as fuel since the war, being utilized by every industry requiring power. It is expected, of course, that with the return of normal freight rates and cheaper coal, this business will gradually die.

Except hardwoods for fuel and interior fittings, such as office partitions, door and window casings, and cross-ties, Argentina depends on imported lumber.

The native trees are stunted in growth, making it nearly impossible to obtain a board more than 10 feet in length of clear timber.

Forestry in New Zealand

"National forestry in New Zealand has been transferred from the region of academic discussion of botanists and of scenic reserves to the region of trained foresters and of practical politics," says the *Australian Forestry Journal*.

The preservation of the necessary proportion of forest is one of the Government measures to be considered in the present session of Parliament.

It is claimed that the clearing off of timberlands has advanced so far in New Zealand that settlers are in imminent danger of being deprived of their supplies of timber and firewood. A campaign is under way to terminate the experiments with exotic species and instead to protect the native forests against fire and improve them through controlled use.

Yield of Danish State Forests

The total cut from the 140,985 acres of Danish State Forests in the fiscal year 1917-1918 amounted to 18,211 cubic feet, or about three times the normal. This increase was due chiefly to the great demand for fuel caused by the war. The cut of timber (3,807 cubic feet), while 50 per cent more than usual, constituted only 21 per cent of the total cut as against twice that proportion in ordinary times. The net money yield from the State Forests amounted to $1,113,063, or $7.90 per acre. Over four-fifths of this yield came from the beech forests of the islands, where the net revenue was $18.10 per acre of productive land. Leaving out of consideration the overcutting caused by the war, these forests yielded a net return varying from 3.9 per cent to 13.9 per cent and averaging 7.7 per cent.

S. T. D.

Mexico Starts Forestry School

In order that a scientific knowledge of reforestry and the protection of existing forests of the country may be obtained, the Mexican Government has established a National Forestry School at Coyoacan, Federal District. The course of instruction will cover a period of three years. The students come from nearly all the States and the school was opened on March 1 with a large attendance. The forest areas of Mexico are very large, but up to this time no scientific regulations or knowledge have been applied to the cutting of the timber. The Government plans also to reforest the more barren sections of the country as rapidly as the work can be carried on.

Major D. T. Mason has relinquished his professional duties at the University of California, for the time being at least, to assist the Bureau of Internal Revenue, in the Treasury Department, in applying the new income and excess-profit taxes to the lumber industry. Major Mason is entering upon his new duties with the full confidence of foresters and lumbermen. We fully agree with what Gen. L. C. Boyle, the coun-

sel for the National Lumber Manufacturers' Association, and the *American Lumberman* say with regard to the grave responsibility and important work which will devolve on him in determining the various elements entering into the cost of production of lumber. Lumbermen are inclined to look upon timber as an exhaustible resource, such as iron ore. Their financial theory, therefore, is that of the finance of mining and not that of dealing with a renewable resource. The continuous forest production, which sooner or later is bound to come to our private forest lands, will necessitate a revision of the entire theory of forest finance and place a different valuation on the investment in mature timber, rate of interest, and depreciation rates, both in timber capital and in investments in mills and equipment. The decisions of the Bureau of Internal Revenue can hasten or delay the coming of the time when the handling of our timber properties must be based on sound financial principles. The country and the profession of forestry will, therefore, await anxiously the interpretation which Major Mason will put upon the various factors determining timber values and revenues.

Capt. Eldredge, of the 20th Engineers, is spending several weeks on the forest which he left as Forest Supervisor when he joined the Army early in the war. He has now received his appointment as Assistant District Forester, and will soon go with his family to take up his work in Washington. Capt. Eldredge's presence on the forest at this time is being taken full advantage of by Supervisor L. L. Bishop, it being his first opportunity to learn direct all the plans and hopes the Captain had had for the Florida when he was its Supervisor. Capt. Eldredge spent seventeen months in the Landes, France, and there came most intimately in touch with the French turpentining industry. His observations are proving of the greatest benefit in planning for the future of the Florida Forest. It is expected that he will be in Florida until about the end of May.

We learn from the report of the Forestry Sub-Committee of the Reconstruction Committee of the United Kingdom that, aside from the land fit for agriculture, there are between 4 and 5 million acres fit only for the growing of timber, and that, if only half this area was afforested, in 40 to 50 years the country would be practically independent in the matter of timber. The committee recommends that forestry be made a State industry, on account of the long-time element. It is proposed to afforest 1,770,000 acres. With 80 as the average

rotation, two-thirds of this area should be planted in the first 40 years. Pitwood would be provided from the quicker-growing species in the better situations from the fifteenth year on and by the fortieth year plantations made in the first ten years should supply sufficient pit props in emergency for two years at the present rate of consumption. At least 150,000 acres of the first 250,000 acres should be planted by State agency and 100,000 by local bodies and private owners, with State assistance and control. A Forestry Commission, composed of six members, and represented by a parliamentary commissioner in the House of Commons, who would answer for the department and practically be its minister, would control the scheme. It is recommended that this commission should also control forestry education and maintain an administration woods for practical work.

Any one interested in Canadian forest and lumber trade matters will find full and reliable information in the Export Edition of the *Canada Lumberman* (Vol. 39, No. 9) issued in May. It is a magnificent publication, of 270 pages, and may be obtained from the *Canada Lumberman,* Toronto, Canada. It is interesting to note that foresters have contributed the bulk of the reading matter. Among the contents are the following articles: Surveying the Forest Resources of Canada, by R. H. Campbell, Director Dominion Forestry Branch; Taking an Inventory of Canada's Forest Assets; How Export Shipments are Carried Through; How the Timber is Logged for the Sawmill, by G. A. Mulloy and W. M. Robertson; British Columbia Export Trade Reviewed, by H. R. MacMillan; Annual Exports of Wood Products from Canada; Province of Quebec, Rich in Timber Resources, by A. Bedard, Assistant Chief of the Quebec Forest Service; How Canada's Timber Limits are Cruised, by P. L. Lyford; Work of Forest Products Laboratories, by J. S. Bates; Promising Outlook for Nova Scotia Lumber, by Hon. O. T. Daniels; Types of Timber Possessed by Ontario, by E. J. Zavitz; Keeping Unimpaired Canada's Timber Wealth, by C. D. Howe.

The Empire State Forest Products Association has begun the issuance of periodic bulletins, the first appearing in February, 1919. This contains the constitution of the association and various other administrative matters. The objects and character of membership should be a power for good to the forestry cause if carried out as stated: "to protect, perpetuate and increase rational and constructive systems of forestry." The membership is open to: "every person, firm, or corporation owning forest land or engaged in the industries of manu-

facturing or shipping lumber, wood pulp, and paper, and other forest products, or in the establishment of a rational system of forestry or in the conservation and development of water power in the State of New York." We note in the membership a number of prominent foresters, and in the program of activities for 1919 a number of genuine forestry problems is proposed, including an effort to secure an amendment of the notorious section in the Constitution of the State preventing cutting of timber on State lands. The president's (G. N. Ostrander) address on a State policy for the development of water power is issued as a separate.

A New England Forestry Congress was held in Boston, Mass., February 24 and 25, 1919, under the auspices of the Boston Chamber of Commerce and the Massachusetts Forestry Association. A full and varied program had been prepared, the following subjects being discussed: Economic Importance of Forestry; The Water-Power Situation in New England; Home-Grown Timber, the Hope of the Wood-Using Industries in New England; Pulp and Paper Manufacture and Its Relation to Forestry; Need for Greater Forest Protection; Co-operation in Forest Fire Protection; Fungus Diseases at Work in Our Forests; Forest Conservation in the State of New York; Social Significance of Forestry; The Need of Private Forestry; State Forest Policy; Restoring the "Sylva" to Penn'a; State Forest Policies in the United States; Forestry Policies of Foreign Countries; Practical Forest Management; Results of 25 Years' Clean Cutting and Selecting Cutting in New England; Is the Disposal of Slash in New England Practicable? A Forest Research Program.

Bulletin 768, U. S. Department of Agriculture, brings the statistics of lumber production in 1917. The cut, with 36 billion feet, was smaller than for 12 years preceding, when it was 40 billion and more. "Attention is directed to the increasingly large per cent of the total production contributed by the bigger operations." Striking is the diagram giving the contribution of various species, which shows how completely yellow pine ocntrols the market with over 13.5 billion feet (38 per cent) ; the next species being Douglas fir, with only a little over 5.6 billion, although in the distribution by States Washington and Oregon outdistanced Louisiana and Mississippi combined. While in the tabulations by species both quantities and values per thousand feet are given, we have looked in vain for a total of values that would give an insight into the size of the industry. We note that the value per thou-

sand feet remains below $25 in the average, excepting for yellow poplar, basswood, ash, hickory, walnut, and sugar pine.

From the report of the Secretary of Agriculture for 1917-18, we learn that in the two years the number of live stock permitted on the ranges of the National Forests was increased by approximately 1,000,000 heads, representing 25 million pounds of beef, 16 million of mutton, and 4 million of wool. "The use of the National Forest ranges is increasing and their productivity is rising under the system of regulation. Never was the wisdom of Government control of these ranges more manifest than at the present time."

From the same report it appears that lack of men, especially experienced ones, an unusually early and severe dry season, and insufficiency of appropriations combined to create an unusual danger of forest fires. Relief was furnished by the President of the last-mentioned trouble by a loan of $1,000,000 from his emergency fund.

The revision of the Forest School curriculum was discussed at a recent meeting at the University of Montana. The Forest Service and local lumber interests were represented, as well as the school faculty. The meeting was fortunate, in that Col. H. S. Graves was in Missoula at the time and was able to attend. The conclusion reached was that students should be given a well-rounded course in forestry without attempting to develop specialists. The course as planned will be sufficiently broad, however, to form a basis for such special work, if the student cares to enter these fields. The lumbermen were very much interested in the course of study, and had many suggestions to offer providing for courses of study which would make the graduates of immediate practical value in logging operations. Such co-operation is bound to result in immense good to the school and to the practice of forestry.

The causes of forest fires in Oregon for five years 1914 to 1918, both inside and outside the National Forests, have just been tabulated by Mr. Talbott. During the five-year period the following totals accumulated: 10,079 fires were reported, destroying 1,706,048 m. b. f. The total damage to timber, logs, and logging equipment for the five years was $2,022,117.74. Total area burned over, 1,240,910 acres. Classified by causes, the fires appear as follows: Railroad, 262; lightning, 2,093; incendiary, 2,274; brush burning, 960; campers, 1,752; lumbering operations, 314; unknown, 1,994; miscellaneous, 265; stock

fires, 165. (This latter is a classification of fires outside the National Forests. Similar fires within the Forests are classified under other heads.)

Dr. D. T. MacDougal, of the Department of Botanical Research, in the Carnegie Institution, has designed apparatus for measuring the increment of trees, which he calls a dendrograph. It consists of a belt of wooden blocks hinged together, with a number of "plungers" in close contact with the tree and an encircling wire with a pen attached, which records the daily and seasonal changes on a drum. This reminds us of an earlier invention for the same purpose by the Austrian Forester, Dr. Friedrich, called increment autograph, described in *Forestry Quarterly,* vol. IV, page 52, which records these changes by an electric attachment in the investigator's office.

The following startling classification of forest conditions in British Columbia is made in the report presently to be published by the Commission of Conservation: 55 per cent, or 200,000 square miles, incapable of producing commercial timber; 30 per cent, or 100,000 square miles, timber once plentiful, now totally destroyed; 7 per cent, or about 27,000 square miles, seriously damaged; 8 per cent, or 28,000 square miles, only statutory timberland. Altogether, it is calculated that 665 billion feet board measure have been destroyed by fire. Not over 8 per cent of the soil of the province is considered agricultural.

The newly awakened interest in forestry matters in the United Kingdom, the result of the shortage of timber supplies in the country during the war, is brought out forcibly in the first part of the *Transactions of the Royal Scottish Arboricultural Society,* January, 1919, which gives a "Discussion on Forestry Administration and Forestry Education at the General Meeting Held on July 3, 1918"; "The Society's Meeting with the Interim Forest Authorities on November 26, 1918"; and "The Interim Forest Authorities and the Training of Foresters."

Dr. Otto Kress, after an absence of more than a year, during which time he was engaged in private work, has returned to the Forest Products Laboratory and assumed charge of the pulp and paper section.

A very complete census of the pulp and paper industry in Canada for 1917 shows, with over 96 million dollars, a rise in value of production

of nearly 140 per cent over the year 1915, when the consumption was 1,405,836 cords, as against 2,104,334 cords in 1917, or about 50 per cent rise. The increase in total capital investment, including three new mills, was nearly 40 per cent, or 53 million dollars.—*Pulp and Paper Magazine of Canada,* May 8, 1919, p. 443.

Among the propositions for the employment of returned soldiers, the removal of hedgerows is suggested in an article by B. N. Wale, in *The Journal of the Board of Agriculture* (March, 1919, pp. 1408-24), showing the large loss of cultivable land the practice of hedgerow planting around field entails. The loss amounts, according to the size of the enclosed field, of from 4 to 18 per cent of land, besides other losses from shade, upkeep, waste of labor, and harboring of insects and birds.

Bulletin 40, of 300 pages, on the "Trees of Indiana," has just been issued by the Department of Conservation. It contains a scientific description and a full-page illustration of each of the native trees of Indiana. The qualities and uses of the wood are given, and the value of each species for shade and for forest planting is discussed. This book is free for the asking, but since the supply is limited, if a copy is desired, application should be made at once.

The U. S. Forest Service is to be applauded for its broadgauge policy of developing all the resources of the National Forests, utilitarian as well as recreational. Such a development is the Laguna Mountain recreation area on the Cleveland National Forest, 14.5 miles from the San Diego-Imperial Valley State highway, on the development of which the Forest Service has already spent $60,000 for an automobile road connection, camping grounds, etc.

The H. W. Wilson Company, of New York, making a specialty of publishing indexes and reference works, has published a three-year cumulation of its Agricultural Index for 1916-18, indexing 88 journals, among which are ten foreign ones. The three-year volume contains 1,056 pages, with 7,075 references. The additions are published monthly. Among the forestry journals indexed is our own publication, as well as *American Forestry.*

The Forest Products Laboratory, at Madison, has prepared a handbook for inspectors and has conducted short training courses in wood

inspection during the war, the inspection of wood in the manufacture of aircraft proving exceedingly important for the industry. Manufacturers having realized the value of men possessing this knowledge, this may be but the beginning of such specialized training.

At Birnam, in Perthshire, there was opened recently the first practical school of forestry in Scotland. The course will cover two years, consisting of both lectures and practical work. The aim of the school is both provision of technical instruction and the furnishing of openings for men discharged from the army. There are at present twelve students in attendance.

Professor Walter Mulford, of the University of California, is performing a good service in the line of propaganda by furnishing forestry notes to the *Sierra Club Bulletin*, published by the Sierra Club, the most active mountaineering club of the West. These notes refer mainly to developments in California and the West generally.

A study of Sitka spruce growth will be carried on during the coming field season. The large amount of spruce cut for war purposes makes material available. The study will be carried on in western Oregon and on the Olympic Peninsula, in Washington. The field work will be in charge of Forest Assistant N. L. Cary.

A new fuel has been developed to eke out the shortage in coal and wood supplies, which comes into the market under the name of *oakoal*. It is made from garbage, manure, street sweepings, and other offal. It is claimed to be equal to the best coal, more economical, and more easily handled and stored.

The President, F. E. Olmsted, has designated S. T. Dana as the member of the Executive Committee to handle the material on Admissions and Paul D. Kelleter as chairman of the committee to arrange for the annual meeting, with R. S. Maddox and Frederick Dunlap the other two members.

The enlargement of the Beal Nursery on the Michigan Forest is under way. The present production is 300,000 trees, which is to be increased to 500,000 in 1921 and 700,000 in 1922. This will provide stock for 700 acres and 1,000 acres, respectively, in the two years.

The separation of forest research in the Forest Service along fundamental and general lines has recently been carried further by reorganization of the scientific force. The fundamental forest research will now be carried on by a corps of trained experts, who will report directly to the central organization in Washington. This will be a mobile force of men that will be assigned to different parts of the country for field-work and whose permanent headquarters will be in Washington. This reorganization will enable the members of the central research corps to work with and meet other men engaged in the scientific work in allied fields and do away with their isolation in remote forest districts. Ultimately it is planned to establish a central research laboratory at the headquarters of the central organization. This plan does not interfere in any way with the field laboratories and experiment stations already in existence. These will continue to be used and developed according to the local needs. The current silvicultural work in the districts will be carried on by a district investigative organization. The district investigators will be in the nature of technical advisors to the district forester on silvicultural matters and also conduct investigations that come up in the administration of the National Forests. By this separation of the personnel along two distinct lines it is hoped that the fundamental investigations can be more clearly defined from the every-day silvicultural problems that arise in the management of the western forests.

A purchase of 1,000,000,000 feet of lumber by Great Britain in Canada is reported. Such an order would be the biggest Canada has had in the past 50 years, and there is some question as to whether it would be possible to fill it in view of the small supply on hand.

The largest yew tree yet reported in Oregon was recently found and measured by Mr. Jackson, at Eagle Camp Grounds. The tree stands in an unfrequented part of the grounds and measures 29 inches d. b. h. It is about 60 feet in height.

The value of the Yale School Forests and the funds for their maintenance and operation exceed $71,000, of which $53,000 is their estimated real estate value. Professor Hawley is in charge of them.

An English walnut tree which grew in Nuneham Park, England, was sold recently for $100. The log changed hands several times and finally

reached the United States. Here it was reduced to 60,000 feet of veneer, which sold for $7,500.

Douglas fir is coming to be used considerably in the manufacture of trunks. In Los Angeles two factories utilize about 400,000 feet annually for this purpose.

A sheepherder in Oregon, failing to put out fires, lighted to keep his herd together, was brought to court and fined $25, although no damage had been done.

New Zealand has requested the Forest Service to recommend a well-qualified forester for a $4,000 position in that country.

In the National Forests there are located three national game preserves and also forty State game preserves.

Mrs. Edith B. Shreve has designed apparatus for measuring the surface temperature of leaves.

SOCIETY AFFAIRS

Membership Matters

The present requirements of the Constitution regarding membership in the Society permit of rather widely varying interpretations. For its own guidance in acting on candidates and for the guidance of members in proposing candidates for admission to the Society, the Executive Council has therefore formulated tentatively the following policy, which is now under consideration and which appears to be favored by a majority of the Council. It is being published prior to final adoption by the Council for the information of and comment by the entire membership of the Society. Members are urged to express their opinion as to the policy as at present outlined, and particularly to submit specific suggestions as to any revision that appears to them desirable, together with reasons therefor. The Executive Council is desirous of following the wishes of the Society as a whole in the matter of elections, but obviously cannot do so unless it is informed as to what those wishes are:

1. Members and Senior Members must be foresters and must be actually engaged in forest work at the time of election to the Society. Distinction between the two grades is based entirely on experience and achievements, the fundamental requirements as to training and character of work being the same for the two grades.

2. "Foresters" are men who have either completed technical training in forestry at a forest school of recognized standing or who have acquired the equivalent of such training in other ways. In the latter case satisfactory evidence must be presented that the training acquired actually covers approximately the same ground as that included in a forest-school course, and particularly the fundamental subjects of silviculture and forest management. "Forest work" covers the four main fields of forest management, forest protection, forest administration, and forest utilization, and may include specialization in any one of these fields, provided such specialization is closely linked up with forest production. Thus forest entomology, forest pathology, forest economics, grazing as related to forest management, and studies of the mechanical, physical, and chemical properties of wood are all regarded as forest work when the primary emphasis is laid on the *forest* end of

the work. When, however, the primary emphasis is on pathology, entomology, economics, etc., the specialist is regarded as engaged in a line of work "related to forestry," and therefore eligible only to Associate Membership.

3. Neither practical experience nor achievement is necessary for admission to Membership. The general policy is to include in this grade practically all forest-school graduates and others who qualify as foresters and who are engaged in forest work. Original election to the Society will ordinarily be to this grade rather than to Senior Membership.

4. Senior Membership is regarded as a somewhat higher grade than Active Membership under the Constitution previous to its amendment. Election to it will be based on achievement, which may be indicated by advancement to a position of responsibility and a noteworthy showing of efficiency in any line of forest work, by some definite and important contribution to the advancement of forestry, or by authorship of creditable publications on some phase of forestry. Experience alone, when involving no more than a routine and satisfactory performance of customary and directed duties, is not sufficient. Change from the grade of Membership to that of Senior Membership is not automatic, and there will doubtless be cases where men will remain indefinitely in the Membership grade. This will be increasingly true as standards for Senior Membership are made more strict with the growth of the profession.

5. It is the belief of the Executive Council that a comparatively small number of men should be chosen as Fellows, so as to make election to this grade a distinct honor. In addition to such nominations for Fellows as may be made by the written endorsement of 25 Senior Members or Fellows, the Executive Council will from time to time review the list of Senior Members to make certain that no men who, in its judgment, qualify for this grade have been overlooked. Nominations by the Executive Council will ordinarily be limited to a few names.

6. Associate Membership is limited to persons engaged in lines of work "related to forestry." Persons engaged in what is obviously forest work, as defined above, are not therefore eligible to this grade. This means that Forest Supervisors and Forest Rangers would be eligible for Associate Membership only in those exceptional cases where they are not engaged in forest work. "Substantial interest" in forestry must also be shown, and candidates must be men who are rather generally known to the profession.

7. The Council feels that men engaged in forest work in America

who have rendered distinguished service to forestry should be honored by election as Fellows rather than as Honorary Members.

8. The requirement of the Constitution that "except as specified for Honorary Membership, members of the Society shall be residents of the United States, or its possessions, or of Canada, or some other part of the American continents," is interpreted as meaning actual residence and not legal residence at the time of election. Any one already a member of the Society, however, who might leave the United States to take up work elsewhere would not thereby surrender membership in the Society. This applies also to men going into other lines of work after election. If these men so desire, there is no reason why they should not continue indefinitely their connection with the Society.

9. In order to provide for affiliation with the Society of foresters who are not eligible for Membership or Senior Membership because of residence, and who do not qualify for Honorary Membership, the establishment of a grade of Corresponding Members, to be composed of professional foresters residing outside of the United States and its possessions and Canada, has been proposed. Aside from residence, the qualifications for Corresponding Members would be the same as for Senior Members and their privileges the same as those of Associate Members. A constitutional amendment along these lines is now being formulated by the Executive Council for presentation to the Society. At the same time that this change is made, it is believed that it would also be well to amend the Constitution, so as to limit Membership and Senior Membership to residents of the United States and its possessions and Canada. Foresters resident in other parts of the American continents would then be eligible for election as Corresponding Members rather than as Members or Senior Members, as at present.

10. The right to wear the Society badge is limited to Members, Senior Members, and Fellows.

Special attention is called to the fact that, in accordance with the policy outlined above, it is desired to expand the membership of the Society to include all qualified foresters in the United States and its possessions and Canada. A large expansion in the number of Members is undoubtedly possible, since practically all forest-school graduates in good standing, as well as some others, are eligible for election to this grade. The number of men eligible for immediate election to Senior Membership is much smaller, but care should be taken to see that all qualified for the grade are proposed. Sections of the Society and individuals are urged to review the list of men in their regions or with whom they are acquainted to determine whether there are not

some who should be proposed for membership. The inclusion of foresters generally in the Society will not only strengthen the Society, but will give the profession a stronger feeling of comradeship and of community of interest than it has had heretofore.

In cases where a man resides in a region covered by a Section of the Society, it is desired to have his name passed upon by the Section as a whole rather than by a few individuals in it before being submitted to the Council for action. In cases where this is not done, the Section will ordinarily be asked by the Council for an expression of opinion. Nominations by Sections should be accompanied with information as to the number of votes cast for and against each candidate and, preferably, with reasons for any negative votes.

All proposals of candidates must be endorsed by at least three Senior Members or Fellows (or a Section), should be submitted to the undersigned, Atlantic Building, Washington, D. C., and should contain the following information:

Full name and grade for which proposed.

Educational institutions attended, with degrees received and dates. In the absence of a degree in forestry, satisfactory evidence must be furnished that approximately equivalent knowledge of the entire field of forestry has been obtained in other ways.

Detailed statement of practical experience in forest work, chronologically arranged, with a summary of principal activities by lines of work.

List of important publications, with a summary of their general character and value.

Detailed statement of achievements, particularly for Senior Members.

Present position, character of work, and post-office address.

S. T. DANA,
Member of Executive Council, in Charge of Admissions.

ERRORS IN THE ANNOUNCEMENT OF CANDIDATES FOR MEMBERSHIP

It is desired to correct the following errors which appeared in the list of candidates for membership in the Society, published May 15, 1919:

Mr. R. H. Charlton was a special student at Cornell University in 1899 and 1900, but has never received a degree from it.

Mr. H. H. Tryon worked for the firm of Coolidge, Brooks & Rogers for about nine months during the years 1913 and 1914, but was never a member of the firm.

Mr. H. C. Belyea (not Balyea, as printed) is now Assistant Professor of Forest Engineering at New York State College of Forestry.

Mr. C. R. Clark received the degree of M. F. from the Yale School of Forestry, not from the University of Wisconsin.

S. T. D.

President Olmsted has appointed a special committee on organization to consider and recommend on matters connected with the organization and business management of the Society, covering such questions as a paid secretary, corresponding secretary, increased circulation of the JOURNAL, advertising, etc. J. G. Peters, chairman; F. W. Besley, and Paul D. Kelleter, members.

The Denver Section of the Society elected the following officers for the year: Chairman, C. G. Bates; Vice-Chairman, J. H. Hatton; Secretary-Treasurer, F. R. Johnson.

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The Society is not responsible, as a body, for the facts and opinions advanced in the papers published by it.

THE SEGREGATION OF FARM FROM FOREST LAND

BY P. S. LOVEJOY

Assistant Professor of Forestry, University of Michigan

Failure to secure the development of a rational forest policy for the lands now waste and idle has been largely due to the assumption that there is inherent conflict between the forest and the farm. This misapprehension must be removed before adequate progress can be expected.

"Forestry" meets with little or no opposition save when it is proposed for specified lands. When so proposed it almost invariably meets with radical opposition. That somebody should somewhere grow timber as a business strikes most people as a wholly reasonable idea, but that such things should be done near home at once strikes them as bizarre. In this opposition there are three principal factors:

1. The idea, still somewhat prevalent, that there can be no real shortage in essential forest supplies. The last ten years has reduced this attitude to the disappearing point, and it is no longer widely current, even among lumbermen.[1]

2. A hesitancy to accept a new procedure. This is a perfectly reasonable attitude and one which publicity of the facts constantly wears away. The difficulties arising out of this item have not passed; and, it should be noticed, conservatism in all matters, especially those affecting property rights, tends to be greatest among those living in the edges of the world current. The "mossback" point of view is a very potent force in the politics of most of our States and especially in the more backward ones.

3. The deep-rooted assumption, often an absolute conviction, that, with rare and extreme exceptions, all land is or is about to become "agricultural."

[1] J. H. Kirby to West Coast Lumbermen. *Lumber Trade Journal*, August 15, 1918, p. 23.

It is this assumption or conviction, I think, which today stands as the principal obstruction to the development of forestry in America.

Between 1850 and 1895 the main effort of "conservationists" was to retain in public hands the remaining public timbered lands. This being very largely successful, the period 1895 to 1905 saw a contest over the administration of the "Forest Reserves" which eventuated in the creation of the National Forests. Since then, as noted by Dr. Fernow,[2] progress has been slow, puttering, and unsatisfactory, especially as respects State and private development. This condition prevails in spite of an extraordinary accumulation of data and a very wide publicity of its portent. Obviously, something has blocked the progress which seemed assured. This block is, of course, temporary, but it would be well for foresters to consider the situation in detail. It is my feeling that foresters themselves are, in no small degree, contributing to the impasse, and that the present offers chances not available in the past and which may shortly become less available.

American foresters have always been too modest in their claims for economic jurisdiction over lands. It is seventeen years since Fernow[3] remarked: "In the well-ordered State, the soils most fit for agriculture should be devoted to systematic food production; but just so should non-agricultural soils, the *absolute* forest soils, be devoted to the systematic production of wood crops." It is ten years since Zon observed:[4] "It would be a short-sighted policy to withhold agricultural lands for growing timber. The fundamental principle upon which a wise national land policy should rest is that every acre of land should be put to the use under which it will bring the highest returns."

Many later discussions from the Forest Service are in similar vein, none being extreme enough to appear in the least provocative and all, doubtless, expressing the sentiment of American foresters.

Dana,[5] for instance, suggests that "many areas in every region can be classified at once as either agricultural (including grazing) or forest lands. Many others will have to be classified as intermediate, . . . or suitable for either purpose, as local conditions and the economic development of the region make one or the other most profitable. . . . A great deal of land that may properly be devoted to forest production today, in all probability, can be used more profitably for agriculture fifty years hence."

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[2] Journal of Forestry, January, 1917.
[3] "Economics," 1902, p. 243.
[4] Forest Service Circular 159, 1909.
[5] U. S. D. A. Bulletin 638, 1918.

No one, seemingly, could reasonably take exception to such ideas. Present opposition to such proposals is of a different character to that of the westerners in Congress who so persistently and inaccurately alleged that great areas of agricultural land had been included in the National Forests. When Senator Heyburn [6] lamented, that "I can look out of my office window and see thousands and thousands of acres of . . . land, now within the Forest Reserve, upon which the white clover grows knee-deep, and timothy is a native grass," . . . his solicitation was not for the hardy homesteader deprived of his heritage. The Senator desired to discredit the National Forest policy and took a sure means to attract sympathetic attention and to sow suspicion and discontent. It would be obvious to his colleagues and the public that clover lands should be used for clover and not for forests, and on such a subject there could be no possible argument. It would follow that foresters had trespassed their forests upon the domain of the farmer.

From this point it is but a step to the sentiment piously expressed by an eminent statesman: "Thank God, we have no forests in Illinois!"

These are but extreme instances of the typical opposition met by advocates of forestry when they propose to dedicate definite areas to forests, and wholly irrespective of whether such dedication is planned to be temporary or permanent. The politician does not create the sentiment—he only capitalizes it.

The sentiment, assumption, or conviction that "*our* lands are too valuable to waste on forests" is still almost universal. Failure to make provision against this sentiment has, time after time, well-nigh wrecked local forest development.

Field men of the Forest Service will testify almost unanimously to the nightmare of their "June 11th" work, and that, where it has been completed by the formal classification of the forest lands, a change in local feeling has been almost immediate.[7]

Today the National Forests suffer most from incendiary fires where grazing interests conflict with forest preservation. This conflict is also severe throughout the South [8] and almost equally through the Lake States. Within five years the State Forest Fire Warden of Michigan rather took credit to his office for the acreage burned over during the season, on the ground that millions of dollars would be saved in the cost of clearing the land for agricultural purposes.

[6] *Congressional Record,* 1907, volume 41, p. 3717.
[7] Buck, JOURNAL OF FORESTRY, November, 1918.
[8] Hardtner, *Lumber Trade Journal,* November 15, 1918, p. 35.

No illustration of the danger in disregarding these widely prevalent ideas can better that of the Wisconsin fiasco. After years of favorable legislation, the appropriation of large sums for administration, fire control, and planting; after legislative authority for the trading and purchase of lands to make up a State Forest Reserve, the entire program was smashed by a State supreme court decision,[9] the case being instigated and carried up primarily because the settlers and communities within the boundaries of the proposed reserve believed the creation of the reserve to be an intolerable menace to their continued agricultural development.

The logical antagonism of the early settler for the forest, as an incubus which must be removed before he could prosper, grades off to the attitude of the average farmer toward his woodlot. Where soil or slope make agriculture even a bare possibility, he regards his trees rather as trespassers, and looks forward to the day when he may run his plow from fence to fence or at least get some pasture where the shade is now too dense for grass. Such an ambition is not predicated upon any serious regard for the actual earning capacity of the land under timber, as compared with other crops; it is a general, ingrained prejudice against the trees and in favor of what is assumed, rightly or otherwise, to be a higher and more profitable use of the land.

So widespread is this feeling that in most, if not all, States the tax assessor tends to agree with the farmer, and the woodlot seldom bears its full statutory levy—which is perhaps fortunate.

Under such circumstances it is a foregone conclusion that promoters will be able to utilize the prevailing sentiment against the forester's forests and in favor of the land-shark's "farm," and no exploitation, be it ever so fraudulent, seems to have been interfered with by local residents, so long as it was of alleged "agricultural" character. Whether in California eucalyptus, Texas pecans, Montana cherries, Wyoming oats, Michigan clover, or Florida citrus; whether the fraud lie in alkali, frost, lack of water, floods, or in the character of the soil or the character of the promoters, "agricultural development" seems always to have been regarded as something sacrosanct, its promoters as inviolate, its trustees of necessity honorable, its investigators of questionable character, and its victims inconsiderable, but damned, knockers.

That a settler, having chosen his homestead for better and for worse, should "pull" for neighbors is understandable enough. His gregarious instinct, his need for funds for schools and roads, his hope of increased

[9] State *vs.* Donald, February 12, 1915.

land values (usually his only real hope for profit), his need for market facilities and transportation and political preferment, and the optimism which took him into the back country; the precedent of a million other fellows in like fix—all make him a "boomer" for his region and locality. Like considerations affect the merchant and professional men of the near-by towns. Once located, their whole "stake" is on the table.

The local interests generate a local pride, which, however ill-founded, makes disparagement of local conditions—social, climatic, or agronomic—a most unpleasant and unprofitable undertaking. The "knocker" is the least popular citizen in any "garden spot." To intimate, however gently, that local weather or soil might permit profitable forest growth is the foulest of calumnies and an aspersion to be suppressed at any cost. Forests, indeed!

The situation has fostered unmitigated fraud and often results in the outright intimidation of worthy officers. Does the Forest Service allow the publication of a mild suggestion that one hundred years of fruitless effort has shown certain lands along the Ohio to be unprofitable in farms and suggest that these lands might be properly used for growing trees, the Senator from that region protests violently. The Forest Service issues a new publication taking it all back—at least to the extent of allowing that other States and regions have still poorer lands.

This intimidation extends into other ranks than those of the forester. Observe, for instance, the extreme reserve with which the several bureaus of the Department of Agriculture approach the subject of abandoned farms and crop—worthless land. Observe the remarks and maps of the U. S. Soil Survey and of similar surveys conducted by the several States and agricultural colleges and experiment stations. Land more profitably devoted to timber than to crops may hardly exist officially at all, save as an unfortunate condition prevailing in some other region.

But only a part of this is the result of intimidation or mere conformance with precedent. A very large part of it is derived out of the technical point of view of the professional agronomist and is wholly legitimate. With this point of view the forester does not much come in contact and it is highly important that he should do so at once. The forester and the agronomist have been fighting each other blindly, to the advantage of neither and to the serious detriment of public interest.

The specialized agronomist usually regards forest trees as but little better than weeds—a last resort for otherwise waste places. In an

abstract way he can see that trees might be handled as a crop, but as a staple, standard, every-day, plant-care-for-and-harvest crop, the forest does not appear in his categories. It is not at all unreasonable that this should be the case, for the world's advance in agriculture during the last fifty years has been marvelous and its possibilities and limitations may not now be sounded out by any one—certainly not by a straying forester.

The introduction and acclimatization of exotics, plant-breeding, and new technique in farm operations constantly modify current practice. Under the new combinations, old and profitless systems become again profitable and new agricultural industries constantly arise. The silo makes dairying a great industry, where corn cannot be depended upon to ripen. Alfalfa opens a new economic era for whole territories; prophylactic treatment of seed and spraying technique and artificial fertilizers re-establish old industries where they were likely to be wiped out.[10]

Professor Nourse [11] points out that "the stone rejected by the builders may become the head of the corner;" that "we have gone to Arabia for the date palm, to Africa for kafir, Manchuria for kaoliang, and have not yet forgotten that for sheer bone-dryness, our cacti beat them all;" that "Michigan grows celery and Wisconsin cranberries in once worthless swamps, the South grows dasheen, Arkansas overflow lands are producing rice . . . fortunes are being drawn from sand lands through the medium of berries, melons, peaches, and . . . vegetables. But of all the agricultural Cinderellas, none presents more engaging possibilities than those offered by the hill lands. It would seem that it was in this field that the most egregious blunders have been made in the past. . . . We know that the hills of New England were pressed into flat-land uses with the most melancholy results, and in every hill section—Appalachians, Ozarks, or wherever—we find the early settler . . . essayed to raise his valley crops instead of devising a hill technique really suited to the circumstances. Hence the backward and unprosperous hill folk. . . . Today the apple and live stock make the Piedmont rich, and so of sheep-raising and horse-breeding on the hillsides of Vermont and New Hampshire which were once insanely belabored to produce wheat; peaches in the rock lands of Connecticut, and fruit and butter from the broken portions of New York."

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[10] See, for instance, Ohio Agricultural Experiment Station, Wooster, Bulletin 217, 1910; ditto, "Monthly Bulletin," January, 1919.

[11] *Scientific Monthly*, February, 1918, p. 116.

"These . . . are only a beginning, for as soon as slopes become very steep or the land much broken, even standard methods of orchard cultivation are precluded, and we must fall back practically upon forest conditions, *but with a chance for more than a forest product.* (Italics mine.) Here it becomes a matter of selecting tree crops of great value . . . the olive, various nuts, . . . the persimmon . . . cork oak . . . bamboo . . . and so on indefinitely."

Prof. J. Russel Smith [12] is another exponent of these very modern ideas and would add to the list oak trees, bred for fruitfulness; the honey locust, for its seed, and various other items.

That these suggestions are far from being preposterous it is just as well to recognize at once.[13] Certainly, there is no visible limit to which such adaptations may not go, and the forester should not quarrel with his brother expert as to the agricultural possibilities of the long future; *but as to the reasonable probabilities for the immediate future the forester may very properly call upon the agronomist to bear witness.*

It is easy enough for an enthusiast to be carried beyond the bounds of practicality—as foresters have very often been reminded by the lumbermen.

And these happy prognostications of the agronomist, plus local pride, plus intimidation, plus precedent, all play very directly into the hands of the "boomer" and of the "land-sharks," so that the long-range agricultural *possibilities* of limited areas have, for whole regions, become the selling slogans of the land grafters, who, under the very guns of the agricultural colleges, proceed to the bountiful harvest of the perennial "sucker" crop.

The degree to which this combination of interests has succeeded in "gumming up" our waste-land situation, especially in the cut-over districts, is really astonishing. Michigan, with 12 million acres out of 36 million in raw condition,[14] and with 4,833,000 acres tax delinquent in 1915,[15] and with half a million acres "foreclosed by the State for the refusal or the neglect of the owner to pay taxes," can still listen to the Lorelei: "A larger portion of the sand lands of the State . . . will undoubtedly be utilized than is at present anticipated. For this purpose fruit-growing is being resorted to where the conditions are peculiarly suitable. These very light sands, instead of being farmed intensively in small areas, will some day undoubtedly be operated in large tracts and

[12] *Geographical Review*, January, 1916, p. 7.
[13] See, for instance, U. S. D. A. Farmers' Bulletin 700, "Pecan Culture," 1916.
[14] Only 35 per cent of the State is shown as "improved land" by the 1910 census.
[15] Records of Auditor General's Office, Lansing.

utilized for grazing purposes, when the proper methods of handling, seeding, and improvement are solved, which they surely will be." "The sand areas, underlaid with a clay subsoil near the surface, give promise of usefulness for horticultural and crop production, as well as for grazing purposes. Where the sand exists as such, without a clay subsoil, . . . the problem of agricultural production is still an unsolved one."

The very long and very unhappy history of land exploitations in the State [16] is dismissed sadly with the remarks: "It is a great misfortune for Michigan that some of her pure sand lands have been sold by unscrupulous speculators to city citizens, who have been parted from their savings of years and left without experience or a soil with which to recoup their lost savings. Experienced farmers could not make a living on these types of soils by operating small areas only, and could not be induced to buy them in this way. It is unfortunate that people, particularly those without experience, will persist in buying poor lands. . . . It is also equally unfortunate that the laws of our country do not afford protection from the misrepresentations of the dishonest speculator." [17]

But this joyous official future must be considered as an almost unduly lugubrious view of the prospects when compared with a still unrecalled publication of the U. S. Department of Agriculture; for, although "The sandy jack-pine plains (of the Lake States) have long been an agricultural problem," and "although more people have left these lands during the last thirty years than are now living on them," . . . "it would seem that the key to the successful farming of these lands has been found," thus settling "the problem whether these lands can ever be farmed profitably or whether they had not best be used for forestry purposes." . . . "With clover for a start, . . . the land can soon be built up into almost any state of productiveness," and this in spite of the acknowledged fact that "this sandy soil needs a little nursing," and that "it lacks nitrogen," is "likely to suffer severely in time of drought," "needs protection from the wind," and "is likely to be a little leachy." [18]

The official soil survey of the State [19] refers to certain widely distributed areas as "outwash plains, sand, or gravel, . . . soil usually

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[16] Report of Commission of Inquiry, 1908, Lansing.
[17] Special Bulletin, No. 70, Michigan Agricultural College, 1914, p. 9.
[18] U. S. D. A. Farmers' Bulletin 323, 1908.
[19] Surface Geology and Agricultural Conditions of Michigan, Board of Geological Survey, Lansing, 1917.

light and requiring intelligent cultivation," and "sandy drift, . . . soil variable, but usually second rate," and even "dunes—usually unprofitable for agriculture." With such statements no fault can be found on the ground of untruthfulness, but still they are typically misleading.

The Office of Farm Management of the Department of Agriculture has been, perhaps, as uncompromising as any official agency concerned, and its contributions to this subject are peculiarly and perhaps unconsciously pertinent. With everybody agreeing on the abstract principle that "each portion of our land area should be utilized for the growing of those products for which it is naturally best suited,[20] and that actual demonstration must dominate all theory, the painstaking inventory of current farming operations must be accepted as the best basis for future procedure.

"Farming on the Cut-over Lands of Michigan, Wisconsin, and Minnesota" [21] reports upon 801 typical farms. With due allowance for the propriety of giving no unnecessary offence, the lack of directness with which the report is interpreted is still noteworthy. The usual color persists, even though it is not, and evidently is not intended to be, deceptive to the wary reader.

"The cut-over district comprises an area of about 30,000,000 acres which is rapidly being developed into farms." . . . "Few farmers in this district are rapidly accumulating wealth, but with economy and good management, there is opportunity to make a living and a little more." . . .

"Strange as it may seem, the lumbermen rated the land that produced this heavy growth of timber as having little or no agricultural value, . . . but a large percentage of these soil types can and will eventually be brought under successful cultivation." . . . "From a strictly business point of view, these farms do not appear to be successful. . . . The owners should not be satisfied with their present conditions, and indeed most of them are not."

"It is important in all cases to make sure that the quality of the land justifies the expense of clearing." [22]

Forty-nine per cent of the 801 farms had a labor income of less than nothing and 88 per cent of the farms returned less than a dollar a day

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[20] Nourse, *loc. cit.*

[21] U. S. D. A. Bulletin 425, 1916.

[22] If all legitimate charges are made against it, the cost of clearing often cancels all hope of profit, even when the site is otherwise favorable. See U. S. D. A. Farmers' Bulletin 150, 1902; Munger, "The Timbermen," July, 1918; Shattuck Experiment Sta. Bull. 91, 1916, Moscow, Idaho; Mich. Ag. Coll. Special Bull. 90, 1918, p. 28.

labor income to the owners. One may doubt that these 801 farms represented a true average for the region, since no statistics as to deserted farms are appended and since it is obvious that the first comers select the best sites available. Perhaps, under the circumstances, it may be just as well not to dwell unduly upon such a situation, once the facts are of record.

Sooner or later this solution of camouflage in optimism was bound to be precipitated by a situation requiring immediate and unequivocal action. To a considerable degree this came about in Wisconsin, where, as a result of the imbroglio which culminated in the wrecking of the State forest program, it became urgent that the actual, current value of large areas be assessed as between agricultural and forest use. This classification was done by State authorities and the work probably represents the most advanced efforts at such segregation yet attempted in America, not counting that done on the National Forests, where the circumstances are radically different from those typical of the non-mountainous cut-over regions.

The report [23] concludes: "The line between soils which can unquestionably be farmed with profit under present conditions and those concerning the farming of which there is doubt should be drawn between medium and fine sand. It is quite probable that, with very skillful management and a full knowledge of their characteristics, a considerable part of these medium sands can be farmed with profit. But the difficulties to be overcome on these soils are so great that, with the knowledge now possessed by the average farmer, the majority of attempts would lead to failure. We do not believe, therefore, that the State should encourage the development of farms on soil of this character at present." . . .

"Attention is called by the Soil Survey to the fact that there are other districts in the State which, because of the great preponderance of land of low value for farming purposes, would be well suited for reforestation."

Under the really difficult political conditions prevailing at the time, this should be recognized as a notable departure from the general practice of the past and, indeed, it is a bold and useful, even if not a bald, statement of conditions as they are.

The Wisconsin report is especially noteworthy among soil surveys, in that it segregates its land classes specifically upon the ground, in that it unequivocally recognizes that the State has areas "which, because of

[23] Soil Survey of Vilas County, Madison, 1915.

the great preponderance of land of low value for farming purposes, would be well suited for reforestation," and, above all, that the criterion for classification is not based upon hypothetical future contingencies, but, instead, the line is drawn *"between soils which can unquestionably be farmed with profit under present conditions and those concerning the farming of which there is doubt."*

Here is a basic formula, wholly satisfactory to the forester and hardly to be objected to by the most enthusiastic agronomist, provided, of course, that the classification thus made shall be subject to revision whenever occasion may arise. This, of course, is taken for granted by foresters.

The point seems to need constant reiteration, that the present dedication of a given area to forest in no manner implies that such land must be permanently so used. Land now in orchard will often be in another crop a few years later, as conditions change and as the sale value of agricultural products fluctuates. Like enough the land still later goes back to orchard again, just as with the shorter rotation crops. Such deliberate alternation between farm and forest has long been standard practice in Europe.[24]

Against this point of view only three arguments seem available:

1. That the income from forest is so low as to remove forest production from consideration in connection with "regular" crops. Such argument would seem to indicate merely a lack of information; for already, over great areas of this country, the sale value of timber products is high enough to guarantee returns quite comparable to those from cultivated lands.[25] Moreover, rapid as has been the increase in the value of farm produce, it is insignificant compared with the rise in value of forest products, which have often doubled or tripled within a decade, and which, once established, hold their levels with fluctuations only upward.[26] With an economic "corner" in timber, due to its destruction two and a half times its rate of growth, there is no level in sight to which the value of wood may not shortly go, save that level which makes the use of wood prohibitive. Any such level will be many times higher than the cost of artifical forest production.

2. That the need for agricultural development of all lands capable of producing farm crops is so great that little, if any, land can be "spared" for growing timber. Such a position would seem wholly untenable, for

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[24] Fernow, "Economics," 1902, pp. 122, 273.

[25] Roth, "Forest Valuation," 1916, Chap. X; Fernow, "Forest Economics," 1902, p. 327; Bailey, Cycl. Am. Ag., Vol. 2, p. 312.

[26] Bureau of Corporations, "Lumber Industry," Part 1, 1913, Chap. V.

only 54.4 per cent of our farm area is reported by the last census as being "improved." In addition to the unimproved land now in farms must be considered the areas of swamp and desert now available for reclamation and that portion of the great logged-off country which is truly of present agricultural value. This cut-over area has been estimated at 228 million acres.[27] It might also be considered that the average acre yields of American farms are greatly below those of other lands, and that the possibilities of increasing farm products is currently thought by most investigators to be less urgent than the maintenance of fair prices for the crops now produced.[28] Moreover, it should be obvious that the chances for increased income per unit of produce are vastly greater for forest than for farm products. Certainly it cannot well be alleged that there is any economic need or justification for the agricultural development of new low-grade lands. That there are very great areas of such lands unquestionably suitable for timber production is surely beyond all question.

3. That nobody is able to classify undeveloped lands so as to segregate land chiefly valuable for farm as against forest. This is, to say the least, unreasonable, and simply leaves land classification to individual judgment and the wiles of the landshark. As to the ability of the individual to select only such land as will "justify a reasonably prudent person in the further expenditure of funds and labor in the development thereof,"[29] official testimony is not at all lacking,[30] or if a typical case is required, Lincoln's will serve. Of his father's Kentucky farm, he said:[31] "I remember that old home very well. Our farm was composed of three fields. . . . One Saturday afternoon the other boys planted the corn in the big field; it contained seven acres—and I dropped the pumpkin seed. . . . Sunday morning there came a big rain in the hills; the water, coming down through the gorges, washed ground, corn, pumpkin seeds, and all clear off the field."

The family finally moves to another State, where another homestead was taken up. Then the family moved yet again, for "Any one who has traveled through the portions of Spencer County (Indiana) in which the Lincolns settled will respect Thomas Lincoln for his energy in moving. When covered with timber, as the land was when he chose his farm, it no doubt promised well; but fourteen years of hard labor

[27] Report Secretary of Interior, 1918, p. 14.
[28] F. C. Howe: "The High Cost of Living," 1918.
[29] The criterion in the case of mineral claims.
[30] See Dana, Commission of Inquiry. (Howe, *loc. cit.*, et al.)
[31] Tarbell, "Lincoln," pp. 17, 45.

showed him that the soil was niggardly and the future of the county unpromising. . . . Today the country remains as it was then—dull, commonplace, and unfruitful. . . . It is a dead monotonous country, which only centuries of tilling and fertilizing can make prosperous."

The historian's comment upon the region is officially confirmed, for there was a decrease in population in Spencer County of nearly 8 per cent during the last census period. In this connection it may be remarked that the census also shows that thirteen States east of the Mississippi, during the years 1900-1910, suffered an actual decrease in the area of their improved lands. "Improved" land which reverts to an "unimproved" condition is almost always automatically on its way to forest, via brush and woodland. Truly, the classification of our lands as between farm and forest has been long under way.

The essential point does not hinge upon such items; it lies in the fact that logging has been and is an extremely rapid exploitation (around 20,000 acres a day for the country), whereas any form of agricultural development is of necessity slow, expensive, and, if successful, dependent upon a whole series of economic and social conditions which are separate from considerations of mere soil and climate. There is, therefore, an economic hiatus between logging and farming. Even under favorable conditions, this interval is one of several decades and, under average conditions, is hardly less than fifty years. With conditions at all unfavorable, the period lengthens indefinitely.[32]

The forester must contend that it is a wholly useless economic waste for logged-off lands to lie idle during this period.

It is a matter for constant wonder that so generally foresters as well as others overlook the fact that in any region which is made up of irregular areas of arable land mixed in with areas of low agricultural value, but still capable of satisfactory timber production (as is so typically the case in the Lake States and South), the maximum economic development can only come with the development of all the land. With farms and forests well mixed and both worked intensively, each furnishes the other a local market and a local labor supply; both are interested in transportation, social conditions, and all items of real and permanent development. Perhaps no point needs greater accent than that there is no antagonism between farm and forest. Instead of being, one a positive and the other a negative, they are complementary

[32] Forbes, Proceedings of Southern Logging Congress, 1917, p. 50; Shattuck, *loc. cit.*

to an unusual degree, and, under stable conditions, must always be so. No island of farms, however rich, if surrounded by barrens or pauper ranches can ever be so prosperous as the farm area surrounded by well managed forest.

The technique of land classification in America has been in process of development since the first settlement. Originally a matter of individual selection of the most promising sites, need for formal survey work grew apace as land legislation increased and as administrative procedure under the land laws became more and more involved. The rapidity with which new situations appeared and the country expanded made "a systematic classification of the entire public domain into classes representing the highest use for each area" more and more impracticable, but of increasing urgency. While we have today a well-established technique for the classification of coal, oil, gas, phosphate, potash, water power, and reservoir sites on the public domain,[33] the early passing into private hands of practically all agricultural areas was largely accomplished before any adequate practice had been developed for this most important of all land types.

The acute need for dependable detailed information concerning the agricultural soils long since becoming evident, the U. S. Bureau of Soils was created and began its field-work, its classifications being based upon arbitrary "provinces" and "types" of rather technical character.[34]

The technique of the Bureau of Soils has been modified from time to time as proven inadequate, but still meets with more or less disfavor among experts.[35] While cumbersome and heavy with confusion for any but an adept, it at least serves to distinguish the larger phases of soil conditions and serves a most useful purpose where still more accurate work [36] is not available. For the segregation of *potential* farm and forest areas, however, the U. S. Bureau of Soil Survey is unsatisfactory.

As a matter of fact, no mere soil survey can serve such a purpose, for the factors delimiting profitable agriculture include many items other than the relative number of soil particles of specified diameter or given chemical content. "It is evident immediately that such a survey must concern itself with many more things than the classification of

[33] U. S. G. S. Bulletin 537, 1913.

[34] U. S. D. A., Bureau of Soils, Bulletin 96, 1913; Lyon, Fippen, and Buckman, "Soils." 1915, p. 718.

[35] Hopkins, "Soil Fertility," 1910, chaps. 9-10; Sauer, 20th Report, Michigan Academy of Science, p. 87.

[36] For instance, Ill. Exp. Sta. Soil Rept. 18, 1918.

soil types and their mapping. The survey inevitably becomes an inquiry into the agricultural conditions and possibilities of the region or, in other words, tends to become a study in rural geography."[37]

That this is the case becomes most evident in considering the circumstances on the National Forests, where, without doubt, the greatest area of land ever classified in one lot as between agriculture and forest has been recently covered.[38] In this case altitude and topography were most often the governing factors, and soil was usually a rather minor consideration. With soil, climate, and slope favorable, it often happens that transportation, market and available contiguous areas are the critical items, and even the social environment may be a factor as important as soil or climate.[39]

Three sets of factors are involved in the segregation of agricultural and forest lands: (1) technical, as soil, water, temperature, and slope; (2) economic, as transportation, market, area of unit necessary to support a family, cost of preparing lands for the plow; (3) social and political, as number of contiguous farm units as affecting the ability of a settlement to support roads and schools, community life, etc.; safety, from forest fires, floods, and diseases, such as malaria.

Failure properly to evaluate all these factors will be apt to result in "pauper industry, and of these pauper industries pauper farming is the worst." As Dr. Mead has put it,[40] "Science should have gone in, hand in hand with settlement. Because nothing was done, these heroic but uninformed souls were bedeviled by the winds, cold, drought, and insect pests. They wasted their efforts, lost their hopes and ambitions, and a tragic per cent left, impoverished and embittered. Nearly all of this suffering and loss could have been avoided, under a carefully thought-out plan of development."

These facts are more and more generally recognized as field-survey work proceeds and as the economic phases of agriculture receive greater attention. The modern conception of the soil survey includes a chapter upon "Agricultural History and Development," and among the utilities of the survey is listed: "Affording a basis of facts for promoting sound commercial, social, and governmental development."[41]

Under such a practice the forester will not be denied his hearing and

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[37] Sauer, 19th Report Michigan Academy of Science, p. 79.

[38] Buck, *loc. cit.*

[39] MacKaye, U. S. Department of Labor, *Monthly Review,* Bureau of Labor Statistics, January, 1918, p. 48; also, JOURNAL OF FORESTRY, February, 1918, p. 210.

[40] "Lane Letter," in the *Official Bulletin,* June 12, 1918, Washington, D. C.

[41] Lyon, Fippen, and Buckman, "Soils," 1915, p. 735.

opportunity, both in the past generally refused by the soil surveyors because of the reasons mentioned and also, of course, because the bulk of their work has properly been concentrated within areas of unquestioned high agricultural importance.

The last few years and months have brought this entire subject into unexpected prominence. It was bound in any case to appear directly, but late developments have greatly hurried things along. There is the "Lane Scheme"[42] for the settlement of returned soldiers, for instance, under which agents have solicited the listing with the Reclamation Service of cut-over agricultural lands, under forms which amount almost to options of purchase. There is Federal tax legislation, which is placing the owners of great cut-over areas in a dilemma of far-reaching importance, in effect threatening to tax away any unearned increment from their cut-over lands, as well as threatening their standing timber.[43] There is the radical State legislation looking toward the breaking up of large estates.[44] There is the promise that the new census will attempt a really adequate inventory of the standing timber and cut-over lands of the nation, "thus aiding the development of a permanent national forest policy and the solution of sundry forest problems," among the greatest of which will be, of course, the waste-land problem.[45] There is the rapidly growing interest on the part of farmers in the matter of cost accounting, much of which is very likely to prove parallel to the discoveries of the Bureau of Farm Management, already cited.[46] There is the war-stimulated feeling that non-productive resources are not permissible, recognition that great territories once forested are now nearing economic bankruptcy, and the certainty that timber supplies are even shorter than supposed.[47]

This new interest in the status of land is not local or typical alone of America, but seems to be common to most of the civilized countries.[48] It would seem obvious that there is soon to open something approaching a new era in our land history.

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[42] Report of the Secretary of the Interior, 1918.

[43] Compton, *American Lumberman*, November 16, 1918, p. 28.

[44] *Lumber Trade Journal*, September 1, 1918, p. 41; *Cut-Over Lands*, December, 1918, p. 4; and January, 1919, p. 16.

[45] *American Lumberman*, November 30, 1918.

[46] See, for instance, U. S. D. A. Bulletin 41, 1914; Roth, "Forest Valuation," 1916, p. 132.

[47] The secretary of the Southern Pine Association states that "inside of eight years, at least three thousand sawmills in the South will be cut out, the annual production dropping from over 8 to 3-5 billion feet." (Rhodes, *Lumber Trade Journal*, January 15, 1919, p. 19.)

[48] Hearings on the "Crosser Bill," H. R. 11329, 1916.

The extent of the cut-over land problem can be gauged from the official estimate that there are now in the United States 228,509,000 acres of such lands, Alabama, Arkansas, Florida, Georgia, Louisiana, Michigan, Minnesota, Mississippi, North Carolina, Texas, and Wisconsin each having ten million acres or more.[49] What percentage of this great area is suitable for agriculture or grazing development within 50 to 100 years nobody can well estimate, but one might hazard a guess that much less than one-half will be put to such uses in the period indicated.

The first need, in connection with the modern land problem, is a dependable land classification, and the rapidity with which this idea has spread is a real promise of early and adequate action. All sorts of unexpected sources are contributing. The Southern Pine Association (members of which are said to own ten million acres of logged-off lands) has a Cut-over-land Committee actively interested in "the definite determintion of the character of the soil . . . so that each class may be put to the use best suited to its character."[50] An ex-member of a Federal Reserve bank suggests the formation of a great trust to take over and develop stump lands, the first work requiring that the land be "mapped, classified, and appraised."[51]

The earliest detailed suggestions as to such a classification of the waste stump lands seems to have been made by Mr. C. F. Ucker, then of the Southern Settlement and Development Organization of Baltimore, an institution financed by the railroads of the Southeast "with a view to developing the idle agricultural land and latent industrial possibilities" of their territory. Mr. Ucker's scheme[52] proposes to make a field classification of idle lands upon the following basis:

"A, those immediately available for general agriculture.

"B, those adapted to grazing and with the grazing, where practicable, reforestation.

"C, those which will not be, during our generation or the next, fit either for farming or grazing to be devoted to reforestation."

Over much of the cut-over area the pressure of events already has changed the aspect from "farms" to "grazing." Sad experience in attempts at agriculture and the urgency of "development" of some sort just now throws the range possibilities of the cut-over lands of the

[49] Report of Secretary of Interior, 1918, p. 15.
[50] *Cut-Over Lands,* May, 1918, p. 8.
[51] *Cut-Over Lands,* August, 1918, p. 18.
[52] Report on Proceedings of North Carolina Forestry Association, January 25, 1918, p. 7.

Lake States and the Southern Pinery into high light. But there is now a note of frankness, even in the "boomers'" literature, hitherto wanting.

A contributing editor of *Cut-Over Lands* (the very existence of such a publication proving the new status of the subject) and a member of the American Society of Agricultural Engineers writes:[53] "There is no sense in the cut-over-land owner trying to deceive himself because profitable development must be based upon the lands as they are. . . . As to productivity, . . . cut-over pine lands, in general, are poor. . . . The problem of the land owner is to determine whether his most profitable crop will be timber (reforestation), cattle or sheep (grazing), or suckers (unwarranted land-selling)."

And, again:[54] "There has been much talk about utilizing the cut-over pine lands of the South with cattle, but very little information is available as to the profitableness of such an enterprise. . . . Perhaps the best advice . . . for those with little experience is not to plunge into the live-stock business." . . .

If to such sound advice the editor of a lumber trade journal reacts by calling it "ill advised" and "theoretical," another writer can remark: "One reads many statements as to the carrying capacity of cut-over pine lands. Let me say that, taking the land in its present state, if a reasonable charge is made for the land, it will take so many acres, that cattle raising will not be profitable."[55] The director of cut-over land utilization of the Southern Pine Association admits that "the pine-cut-over area . . . is now extending at the rate of approximately 51,600 acres per day. . . . Something must be done to maintain a permanent industry," . . . and advocates the gradual development of the region through settlements, agriculture, grazing, and reforestation, according to a well-considered plan which would require, of course, a genuine land classification.[56] There will be no such long-drawn controversy between grazing and forests as between farms and forests. The problems involved are so urgent, so obvious, so complex, and so utterly dependent upon a really adequate and dependable land classification that it will not require much further agitation to bring action on a previously unknown scale.

The high wave of "conservation" made its peak about 1909 and was

[53] *Cut-Over Lands*, June, 1918, p. 6.
[54] *Cut-Over Lands*, July, 1918.
[55] *Cut-Over Lands*, November, 1918, p. 20.
[56] *Cut-Over Lands*, November, 1918, p. 15.

generated largely out of sentimental rather than business considerations. Of late years we have been in the trough following that wave. Now a new crest is in the making, this time to be generated out of economic factors. "The timber-holding function" of the lumber industry, for the first time, is really under consideration. No one can well doubt what the new census, if adequate, will show. The "sinister land concentration" promises soon to recognize that it is tired of hanging on and afraid to let go.

Within the next few years it seems very certain that we shall formulate new policies with respect to idle lands, and that these policies will conform to the doctrine of highest use.

But that is a generality; this business now requires particularity. It is time that foresters revise their mild request to be permitted to work such remnants of "absolute" forest land as may some time be bequeathed to them by dead and dying agriculture. It is time, indeed, to send "absolute forest land" to limbo. The forester can and will utilize to good advantage the offal of the agronomist, but there is no more sense in foresting jack-pine sands or mountain tops while a hundred million acres or so of decent land lie fire-swept and barren, generation after generation, than there is in permitting thousands and thousands of misguided innocents to be beguiled into an agricultural suicide in order that a landlord may collect his unearned increment.

It is time that we formulated the principles of land use and discussed the procedure of land classification. Only one general principle would seem basic:

It does not pay to work land which it does not pay to work; and conversely.

The segregation of farm from forest lands will be well accomplished by answering, for each type or parcel, the following questions:

1. Is it being profitably farmed now?

2. Is it a reasonable presumption that it will be profitably farmed within the period required for a forest rotation on the site? If that presumption is not reasonable, that area belongs in forest and should stay in forest until that land can undoubtedly be farmed at a profit. Any opposite contention must seemingly hold that non-productive land is better employed than when productive.

Such a *classification* would be adequate for the forester and for the agronomist as well. The mere drawing in upon a map of such classes would give such striking results that action upon the matter would hardly be long deferred. It is unlikely that a group of fair-minded

experts would differ greatly as to the location of such class lines. The actual field-work of such a classification would be simple and its cost might often be but a cent or so an acre.

But, useful as such a segregation would be, it in itself falls far short of furnishing data adequate for anything like a plan of development for either the agricultural or the forest lands. Manifestly, in each case, the most productive lands should be first improved. Different site conditions will call for different species and treatment and forms of management. To anticipate and plan such affairs requires a mass of base data which can only be made available through a real *survey*.

The sort of survey required will differ from existing practices only in its comprehensiveness. It should embrace topographic, Geological, geographic, agronomic, forest, and economic work at least.

In each of these fields the technique is well developed. Already the several groups have been very successfully combined in the land-classification work of the Forest Service, which has quietly developed topographic forest and grazing survey methods to a remarkable degree. The work of the Soil and Farm Survey is equally well established. Individuals competent to do such work are easily available. Organizations are actually at work dealing with one or another of the phases of the larger undertaking. It now remains to develop the procedure of co-operative work under a really comprehensive plan. To accomplish this will not be easy, for professional and departmental prejudices and jealousies must be composed and conflicting interests must be placated. Federal, State, and private interests are immediately and directly concerned. Already the Reclamation Service, through its handling of the "Lane Scheme," is beginning to function as a clearing-house for the many interests affected. It is probable that the situation will develop rapidly and it would certainly be well if everybody concerned might be consulted in the beginning.

The Society of American Foresters might properly undertake a canvass of the situation.

THE LUMBERMEN'S ATTITUDE TOWARD FORESTRY[1]

By Harry T. Kendall

General Sales Agent, Kirby Lumber Company, Houston, Texas

Lumbermen know that without reforestation the lands which now carry a stand of timber must become exhausted, to the ultimate destruction of their business and to the embarassment and injury of posterity.

The Texas lumbermen likewise know that there is little probability that the laws, organic and statutory, will be so changed that forest lands under private ownership may be carried for a sufficient time to enable those lands to produce a crop of trees.

Under the constitution of Texas, taxation must be uniform and must be based on the fair market value of the property subject to taxation. There is no probability that the constitution can be changed in that regard; therefore it is impossible that privately owned lands may be utilized for reproducing our forests. Only the State can undertake such an enterprise; and the question is, Will the State do it?

The farmer gets each year a crop from his land which enables him to pay the taxes and other carrying charges, whereas the forest owner gets a fair crop only once in fifty years. If he cuts his timber in shorter periods, he is sacrificing his values and injuring posterity.

The home-builder in Texas in the next generation will have to obtain his building materials in the far Pacific Coast country, paying exorbitant prices and high freight rates. The present generation seems to take no note of this fact or, if it has noted it, it seems unconcerned about the generation yet to follow.

There is only a relatively small area of Texas adapted by nature to forestry growth. It seems a crime against posterity not to keep that area perpetually so employed. The question is, Will it be done?

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Like the average business man, I regret to say that I have not watched closely the political situation in my own State; consequently I was very much surprised in reading the platform of the Republican candidate for Governor to find that that gentleman was attacking the Democratic candidate because he was considering plans looking toward solving the forestry problem. The Republican candidate stated in case he was elected the citizens of the State might feel sure that he would

[1] *Cut-Over Lands,* Vol. 2, No. 1, April, 1919, pp. 20-23.

not enter into any arrangements with the lumber barons of the State, who were attempting to force on the public immense quantities of cut-over lands. Personally, I did not know that any lumberman had made a proposition to the Governor to purchase any cut-over lands with an idea of reforestation; but if such a proposition has been made, it was not because the lumberman expected to profit thereby, but because the lumberman saw the necessity of the State following the policy of the United States Government, to either purchase or withdraw from sale suitable land for reforestation purposes. I say, as a lumberman, that we are not interested in this proposition, because capital that is presently employed in the lumber business will be otherwise employed before any lands that might now be segregated for reforestation will produce timber for the market. As a citizen, however, who will find himself in a short period engaged in some other business and be compelled to purchase lumber that will be either grown in Texas under reforestation plans of the State, or who will purchase lumber from Washington or Oregon, the lumberman has vital interest in forestry problems, and every other citizen should see this situation plainly.

A SURVEY OF THE LUMBER INDUSTRY

When Mr. John H. Kirby was acting as Lumber Administrator for the United States Shipping Board, Emergency Fleet Corporation, he caused to be taken an extensive survey of the lumber industry of the South. Mr. Kirby and the other lumbermen engaged in making this survey considered themselves fairly familiar with the timber possibilities of this section; but when the results were finally tabulated, showing the amount of available timber and the life of the sawmills now engaged in cutting it up, they were astounded to learn that 80 per cent of the sawmills now engaged in the manufacture of yellow pine would be out of business within five years or less. Five years may seem a long time to an industrial enterprise, but five years to the citizenship of the State of Texas is so near at hand that the day of reckoning is not in the future, but is with us now. To the citizen who is considering forestry problems the present system of wild-land taxation is entirely and radically wrong. Under it a man must cut his timber, whether it is ripe or not; otherwise his taxes will eat it up.

Now this problem is not one for the lumberman, nor, under existing laws, is it one for any private investment or consideration. Its solution lies wholly with the State. Governments, like men, move only through necessity. Up to the present time the State of Texas, like

other Southern States, has not felt the necessity of considering forestry problems, but the necessity for such consideration now requires some action. The simplest method would be for the State to purchase cut-over lands suitable for reforestation, withdraw them from taxation, and place them under the control and protection of the State Forester. The ultimate result of this would be extensive tree-planting of wood, the safeguarding of these forest areas from fires and other dangers, and the evolving of a system of cutting that would insure a perpetual supply of forest products. It is not likely that within the time any plans mature covering extensive withdrawal of forest lands and their growth to mature forests that the State of Texas would become so crowded that these lands would be needed for agricultural purposes. Furthermore, as a general rule, pine forests grow better on land not entirely suitable for agriculture, except under intensive and expensive development.

THE ONE ALTERNATIVE LEFT

The failure of the State of Texas to take up this problem and deal with it as a problem of and for the entire people leaves one alternative, viz: In the development of the immense areas in the western part of the State the new citizen, instead of being able to buy native-grown lumber at a fair price, on comparatively low freight rates, must materially increase the cost of his improvements by paying for lumber shipped from distant parts of the United States at heavy transportation costs.

I wish to again impress upon you this fact; that, as a lumberman, my interest in forestry is nil. Nothing can now be done by the State that will bring one penny's benefit to any lumberman now engaged in the manufacture or sale of forest products. When the lumberman of today saws the trees he owns and scraps his plant, his capital will enable him to become the banker, the ranchman, or the manufacturer of some other commodity, or with his capital and experience he can continue business in other sections of the country where timber is still available. But, on the other hand, the lumberman, as a private citizen, being closely in touch with the situation and realizing, as the great body of citizens must soon realize, the necessity of some definite forestry project under the control of the State, his interest is a serious one, and as a citizen I raise my voice to appeal to you and to the other citizens of this State to face the forestry problem fairly and squarely and deal with it in the only possible way, viz., the State to acquire suitable lands for reforestation purposes and to safeguard and handle the growing forests along recognized lines.

WHAT IS POTENTIAL FOREST LAND?

By Crosby Hoar

Forest Examiner, U. S. Forest Service

Interpreted literally, the question means not what constitutes National Forest land, but forest land anywhere. Let us consider it briefly from that standpoint and ask what is meant by the term "potential forest land" in its broadest sense. I shall try to define it as "land suitable for the growth of tree species in stands."

I did not say suitable for continued growth, because where one crop of timber has grown, another should ordinarily be able to follow. Any unusual interference with natural reforestation, unless it destroys the soil, will only postpone, but not prevent, the second crop. Therefore, nine times out of ten, if a tract has once been forested, it is still potential forest land.

The definition specifies tree species, but we need not split hairs in trying to distinguish between trees and shrubs. Possibly some of the oaks in the Rocky Mountains deserve to be classed as trees. If so, such oaks form forests, and their habitat is forest land. This is only another way of saying that such oaks, when in stands, perform the functions of a forest, both as regards their mutual interdependence and in their effect upon run-off soil formation, etc.

It will be noticed that the definition requires potential forest land to be suitable for the growth of tree species *in stands*. The insistence upon stands is important; not the requirement of actual existing stands, but the ability of the site to produce them. By stands is meant a collection of trees of one or more species growing in such proximity that they mutually influence each other. This would classify as non-forest the ledges and cliffs upon which an occasional tree gains a footing and maintains a precarious existence, too far removed from its neighbors to influence them in any way. On benches or pockets in such a formation, or wherever trees could grow *in stands*, there might be potential forest land.

Finally, the definition given supposes the growth of trees in stands only under natural conditions or such artificial conditions as are economically practicable. Lands requiring irrigation or artificial drainage to grow trees are not potential forest lands within my meaning. The fact that planting or seeding may be in prospect does not alter the

situation, however. Tracts which can be artifically forested or reforested at reasonable cost not only have the inherent qualities of forest land, but in a majority of cases would ultimately be reforested naturally.

Turning to the National Forests, as distinguished from any other forest land, a greater latitude is allowed. Congress has authorized their reservation for the avowed purposes of producing timber and protecting watersheds. In this dual purpose there is justification for holding within them certain areas which are not even potentially suitable for timber production, if they are clearly important for watershed protection. This is best expressed in the agreement between the Secretaries of Agriculture and of the Interior, which defined in detail the kind of land to be retained within the Forests, or to be added to them if authority for additions could be secured. This, although of long standing, is still in effect, and is so important that it is given in full:

THE PRESIDENT,
The White House.

SIR: After having very carefully considered the matter of eliminations from and additions to the National Forests, we respectfully recommend that the following general policy be adopted:

1. Lands wholly or in part covered with brush or other undergrowth which protects streamflow or checks erosion on the watershed of any stream important to irrigation, water power, or to the water supply of any city, town or community, or open lands on which trees may be grown, should be retained within the National Forests, unless their permanent value under cultivation is greater than their value as a protective forest.

2. Lands wholly or in part covered with timber or undergrowth, or cut-over lands which are more valuable for the production of trees than for agricultural crops, and lands densely stocked with young trees having a prospective value greater than the value of the land for agricultural purposes, should be retained within the National Forests.

3. Lands not either wholly or in part covered with timber or undergrowth, which are located above timber line within the Forest boundary or in small bodies scattered through the Forest, making elimination impracticable, or limited areas which are necessarily included for a proper administrative boundary line, should be retained within the National Forests.

4. Lands not either wholly or in part covered with timber or undergrowth, except as provided for in the preceding paragraphs, upon which it is not expected to grow trees, should be eliminated from the National Forests.

We have the honor to be,
Very respectfully,
Your obedient servants,

(Sgd.) JAMES WILSON,
Secretary of Agriculture.

(Sgd.) R. A. BALLINGER,
Secretary of the Interior.

A little study of this document shows that it is very liberal. Provision is made for retaining within the Forests timber land, reproduction, brush land, and open land capable of being forested, with the proviso that it shall not be chiefly valuable for agriculture, and with the further proviso that the non-timbered land shall be important for watershed protection or else shall be held only to maintain a practicable boundary. In other words, the agreement gives ample leeway for adjusting the Forest boundaries according to the evident intent of Congress, so as to include land chiefly valuable for the production of timber and the protection of watersheds. If the agreement had governed the original establishment of the Forest boundaries, or could be applied at present to possible additions without an act of Congress in the restricted States, instead of merely to eliminations, the situation would be much better.

Consider what has been done. The National Forests of District Two (Rocky Mountain District) have come to their present form and area through a long series of proclamations, beginning in 1891 and extending to the present time. They were laid out hurriedly, under pressure, and doubtless without any such well-defined policy as that of the Secretaries' agreement. Some of the work was done well, some atrociously. In general the plan was, properly, to make the boundaries inclusive rather than exact. However, large areas of either potential or actual forest land were left out, and some which might probably be so classified have since been eliminated. Having secured the withdrawal of the Forests, we began to prune them, cutting off agricultural land, grazing land, and with them some forest land. The Service was a young organization; it lacked perspective. It was hard to secure uniformity in the handling of eliminations, and much of the work was done at the instance of interested people and agitators. Consequently, although the boundary policy has tended to crystallize, particularly since the Secretaries' agreement, I think it is by no means mistake-proof as yet.

As originally laid out, the Forests included along their borders some land of small forest value and of real agricultural value. Gradually settlement has moved up the slopes, and the Forest boundary has receded before it in repeated eliminations. The limit of this movement has about been reached. Land classification and the natural evolution of Rocky Mountain farming have combined to determine pretty definitely what land can be farmed and where the upper limit of the settlements will be. Sometimes these invade the present boundaries, and the alienations cut up the Forest lands and destroy their continuity. Thus is raised the question how far the Service should go in eliminating sec-

tions that are broken up by alienated lands. I think it ought to be very carefully done. Bodies of timber which would be of minor importance at a high elevation assume considerable importance when close to prospective users. A pole patch or a small stand of house-log material, if located where settlers can reach it readily, is going to be in great demand. If eliminated and cut destructively, its value is gone. Is it not the performance of an important service to the community to hold such tracts when they are chiefly valuable as forest land, and so administer them as to keep them permanently useful to all? Is not their importance so enhanced by their location that some extra pains ought to be taken to preserve them? Their administration is not so difficult as it might appear, because Forest officers will visit the settlements and travel the roads in the performance of other work. Frequently a much-traveled route from the ranger station to the interior of the Forest goes through such places, and the ranger must pass them, whether he has work there or not. Each such place constitutes an administrative problem not germane to our topic, but this point may be made: If there ever was a time when the National Forests were to be thought of as closed to the people or administered by a bureau out of sympathy with them, it is long since gone. We are making the Forests as accessible and as useful to the people as we can. Increasing use means increasing contact, as well between National Forest and private lands as between Forest officers and Forest users. It is a bad augury for the future of the Forests if we must keep backing away, higher and higher up the slopes, constantly trying to keep out of the way of civilization. The communities of France and other European countries, where intensive farming and intensive forestry are carried on side by side, may in a limited way have their counterparts in portions of our National Forests.

Within the Forests are many tracts of deeded land, not chiefly valuable for agriculture or for minerals, but similar in character to what is being held for forest purposes. Often they are timber claims or grazing lands in some key position, the ownership of which permits the fencing of a range, the blocking of a road, or the occupancy by an individual of land which ought to serve a public purpose. Good administration will require that such lands be secured to the Forests through exchange or purchase. Obviously, careful investigation into the character and possibilities of such lands will have to be made before they are acquired. Heretofore the Service has been administering lands which, in a sense, did not cost anything—Forests which have been

carved out of the public domain. The surrender of other lands or of hard cash for the deeded lands that are to be acquired will emphasize the importance of wise selection, and especially of detailed investigation upon which to gauge their potential uses and their cash value.

It may seem that the discussion has wandered from the subject, "What is Potential Forest Land?" If so, it has at least pointed the need of an answer to that question. So far, the determination has been made under a system of "cut and try." No rule and no ready-made answer have been found, and probably none will be. A great deal might be said about the nature of the problem and ways of attacking it which the limits of this paper do not allow. Let land classification serve as an example.

The Forests have recently been classified, to learn the location and area of lands chiefly valuable for agriculture. It is a notable work; perhaps the most comprehensive and far-reaching achievement of the Service to date. It has settled the question aimed at, in so far as it was humanly possible to settle it at the time, but only a fatuous optimist would claim that it will remain correct in its entirety. Changing economic conditions and improved farming methods may require the listing of lands that are now non-listable, or public uses may develop to a point where some of the farming lands will no longer be chiefly valuable for agriculture. The Forest Service must keep abreast of developments and ahead of them. Land classification has given us a breathing space in which to check our conclusions, strengthen them, or revise them. If the Service ceases to be open-minded on the subject, it will have ceased to progress.

We believe in the permanence of the National Forests. If we are optimists, we believe that ultimately each type of land will be put to its highest use. That may mean that the Forests will be enlarged or it may mean further eliminations; perhaps both. Time will tell what the highest use of each type is. But we cannot afford to wait; we cannot afford to settle back with the contented self-assurance that we have done the best we could, and wait for developments to upset our conclusions. Success will be achieved in proportion as the Forest Service foresees developments and prepares for them—not merely for five years ahead, but for the indefinite future.

It is significant that the most practical and applicable data upon the question of what should constitute National Forest land that have yet been secured came from the most far-reaching study—land classification. Along that way lies the solution. I do not mean merely con-

tinued investigation into possible agricultural lands, but rather systematic study of all kinds, using the data furnished by land classification, and becoming more and more intensive as the field is narrowed. If land classification has shown that 75 per cent of the Forest area is certainly suitable for National Forest purposes and not more valuable for something else, there remains only 25 per cent on which to concentrate. In proportion as the value and possibilities are doubtful, the study of them must be more intensive.

It is hard to say just what form these investigations will take. There will always be need to study economic conditions, agricultural development, transportation, land values, and other lines which are virtually a continuation of land classification. They are fluctuating factors, which we should study to keep up with changing conditions or, if possible, ahead of them. But there is another kind of investigations covering what might be called the stable factors. Climate is one of these. Climatic records for a period of years will give average figures which may be confidently expected to be representative of any similar period later. Streamflow, though perhaps more variable, is also relatively a stable factor. Soil is pre-eminently stable. An accurate determination of soil composition and values will be nearly as good fifty years hence as now. Is it not possible that the detailed study of soils offers a chance of learning something very definite about potential forest land?

The experience of the Rocky Mountain District with soil experts in land classification did not demonstrate that they were of much help, because the thing they could give was not what was most wanted. They merely said that certain soils were agricultural, and the Forest officers had to say whether other conditions combined with that fact to make them listable. But the accuracy of their work has apparently not been questioned. Suppose they had been trained to determine forest soils instead of agricultural ones. Though the two classes overlap, they are by no means the same. If we had soil experts who could say, "On this soil you may expect to grow timber, while that is not suited for it," we should have taken a very long step, not only toward determining potential forest land, but toward improving administration. Whether soil experts can tell us this with certainty I do not know, but I see no reason why with sufficient study forest soils cannot be determined as accurately as agricultural soils.

The whole question of the investigation needed to determine potential forest land fits in with our other studies. It is undoubtedly one of the things that Colonel Graves had in mind in his recent article on

"Research," in the Washington office Weekly Bulletin. As a lands question, we may call it classification; from a silvicultural standpoint it might be related to timber surveys, and in its broadest sense it is research. The need for detailed investigations is constantly coming up. We find it in trying to develop a game policy for the National Forests without adequate knowledge of game and game ranges outside the Forests. We find it when we try to make a rough plan for silvicultural management, with a totally inadequate knowledge of growth, or even of the available stand on our Forests. Think of the untold misery and privation that has resulted from the Nation's policy of unrestricted land settlement, under which, for lack of classification, thousands of settlers were allowed to make a hopeless fight against impossible conditions, and finally to give up, impoverished and embittered. The answer to most of our problems will be reached or approached only through detailed, painstaking, scientific study. As the Forester has emphasized, the need for it runs through all National Forest work. It is everybody's job.

EFFECT OF CHANGED CONDITIONS UPON FORESTRY[1]

By W. W. Ashe

A realization and a forecast for the Appalachians: A realization in the increase in the value of low-grade timber, which within the past decade has revolutionized utilization; a forecast that the motor truck in its turn will within the next decade revolutionize the method of operation.

Recitals of price are meaningless without knowledge of conditions. The axis of the Southern Appalachians, extending from Pennsylvania to northern Alabama, is the great valley dividing this region into two provinces. The eastern sector, embracing the Blue Ridge, has forests in which chestnut prevailingly predominates, this species sometimes forming over large areas more than two-thirds of the cubic volume of the stand, while chestnut oak comes next in volume. The western sector, embracing the Cumberland and Alleghany plateaus and Sand Mountain, has forests in which chestnut is less conspicuous, forming probably not to exceed one-fourth of the volume, but in which there are stands of fine white oak and considerably more chestnut oak than to the east. Chestnut and chestnut oak, both yielding largely low-grade lumber, form the matrix of the most widely disseminated forest types in both sectors, and there is in addition considerable Spanish oak and black oak, beech, birch, maple, and hemlock, all likewise low grade. Poplar, long the index of forest values in this region, forms less than 5 per cent of the volume, and red oak, which nearly equals poplar in quality and price, forms a smaller portion of the stand. Old stands of chestnut produce lumber of which not to exceed 15 per cent is No. 1 common or better, 80 per cent normally being sound wormy grade; but a considerable proportion of such trees are too defective to be utilized for saw timber and are converted entirely into tannic acid stock. Chestnut oak yields very little lumber above No. 2 common grade. These and other low and medium grade species form more than 90 per cent of the cubic volume of the stands.

In 1910, under the then existing freight rates, the larger portion of the lumber of these trees was not profitably marketable in the general consuming centers. Selecting typical upper and lower grades and com-

[1] Prepared for Society of American Foresters, March 20, 1919.

paring their prices of ten years ago with their present prices shows the handicap under which lumbering was carried on until the end of the first decade of the century.

In 1909 the cost of operation, including stumpage and selling, for the lighter woods in the Asheville zone was around $16 per thousand and for heavier woods about $1 higher. The selling price of sound wormy chestnut lumber, which forms at least 30 per cent of the volume of the stands, was about $12.50 per thousand, this price being $3.50 less than the cost of operation; the price of No. 2 common oak, which forms from 10 to 15 per cent of the volume of the stands, was about $2 less than the cost of operation—that is, the selling price of at least one-half of the volume of the stands was below the cost of operation. While operating costs have increased approximately 57 per cent and prices of upper grades of chestnut only about 37 per cent, that of sound wormy grade lumber has increased 190 per cent; No. 1 common poplar only 70 per cent, but No. 2 has increased 100 per cent; while No. 1 common oak has increased 66 per cent, No. 2 has increased 94 per cent. In each case by far the largest per cent of increase has taken place in the lower grades, and since only the choicer trees in many cases are being cut or have been cut, the stands contain a continually increasing portion of these lower grades, which are the ones most rapidly increasing in price. This high rate of increase in the lower grades should have an important bearing on deciding which class of timber can most profitably be held for investment, and should be an important consideration in forest management.

While the increases in the prices of the upper grades of lumber and of choice stumpage have been very largely absorbed by the increased cost of operation, low-grade stumpage exhibits a good margin beyond the operating increase and low-grade stumpage of most species has more than doubled in value; while low-grade chestnut has more than trebled. Chestnut stumpage is now selling for tannic acid stock at from 75 cents to $1.50 a long cord of 166 cubic feet with bark on; saw timber at from $2 to $4.50 per thousand, log scale. Tannic acid stock does not consist only of material which cannot be used for lumber; the manufacturers of tannin extract successfully outbid the millmen in competition for medium-grade timber. Yellow-poplar stumpage sells at from $5 to $15 per thousand; red oak and white oak from $3 to $10; chestnut oak (excluding bark) from $2 to $4; Spanish oak and other low-grade species from $1 to $3. The stumpage and profit margin which has now been established is sufficient to insure a latitude of method in

logging sufficient to permit the reservation of timber—low grade for price appreciation, small trees for accretion, or trees of the choicest species for seed trees, if selection of such seems genetically desirable.

If the negative value of certain species and classes of trees has been a deterrent to silvicultural practice, the necessity for extensive operations has been an additional unfavorable factor, requiring railroad construction and high overhead and calling for the contribution of all stumpage to reduce the unit value of construction. This has necessitated practically clean cutting, with the prospect of a long interval before another cutting would be possible on the cut-over land and with little opportunity for determining the choice of species in the restocking. The passage of the big operation in the East is imminent, however, not only in yellow pine (as recently forecast by Mr. J. E. Rhodes before the Yellow Pine Association), but it is about to take place in the Appalachians as it has already taken place in the Northeast. The outlook a decade ago was that after the big operators had cut out there would be reversion to the sash saw and the portable circular outfit, with its wasteful kerf, desultory practice, and unprogressive operator. These provided a low-grade product which commanded a relatively low price, but from certain angles was favorable to the promotion of silvicultural practice, since cable logging, with its consequent breakage of small trees, was not employed and frequent cuttings could be made on small units.

Now, however, the motor truck and the portable band-mill seem likely to furnish a combination which will banish the circular mill, because they supply the efficiency and cheapness of railroad operation, and are applicable to stands of low-grade timber and to small and scattered tracts. At the same time there is secured a higher grade of lumber than is possible with the usual inserted-tooth circular sawmill. The motor truck is being used for logging as well as for hauling lumber, and the fact that the portable band-mill may be economically moved for a cut of a million board feet assures adaptability. This is not only an industrial advance, but it affords the possibility of cuttings at frequent intervals without materially added cost.

A case can be cited of an Appalachian operation with a holding of 20,000 acres, located 20 miles from a shipping point. After considering building a railroad, it was decided to try out trucks on account of their low overhead, although it was realized that, on account of wet earth roads, hauling with them could be possible only about nine months a year. The haulage cost of this operation, including full charge for

replacement of trucks, is between $1.50 and $1.80 per thousand. This is somewhat higher than the cost might be under continuous railroad operation, but is less than one-third of the cost of team haulage at the present time. Moreover, it permits intermittent operation without serious depreciation in the investment or material increase in cost of hauling. It further means that the unit of logging operations need not be a single body, but may be a number of bodies of timber reached by convenient roads. It implies an entire readjustment of our concept of a logging unit. As employed by the operation just mentioned, trucks are also performing excellent work in logging whenever the weather and road conditions are such as to permit hauling on special woods roads constructed at a cost of about $300 per mile. A truck is loaded with logs and makes the trip of a mile and return within less than an hour, a 7-ton truck being able to deliver about 20,000 feet of logs a day. Caterpillar tractors especially meet the conditions.

Many of the conditions in the Appalachians are particularly favorable to the employment of autotrucks. The mixture of timber is not uniform over the mountains, but is concentrated in the deep coves or narrow valleys in which roads are located or must be located. The deeply dissected terrain results in three conditions of site and forest: (1) the drainage lines or coves which afford the best facilities for tree growth and contain stands of the best quality; (2) the slopes well timbered with species of medium value; and (3) the dry upper south sides and ridges deficient in moisture and lightly timbered.

Considering the region from Pennsylvania south to Alabama as a whole, less than 10 per cent of the area is in coves with stands of a heaviness represented by 10, about 70 per cent of the surface is on the slopes with stands of a heaviness of 4, and about 15 per cent along dry south slopes, ridges, and crests, with stands of a heaviness of 1, while 5 per cent is nonproductive. At the present time the relative unit value of the timber in these stands is respectively 5, 3, and 2; so that the per-acre value is in the relation of 50 for cove, 12 for slopes, and 2 for ridges. Consequently more than one-third of the total timber value is on one-tenth of the area and somewhat less than four-fifths is on about one-half of the area. This necessitates comparatively few roads to penetrate the greater portion of the timber-producing land.

The road systems of the Appalachian Forests should be designed primarily for developing the forests by truck service, with larger logging units than circular mills demand. Many heavily timbered tracts which otherwise would be operated by logging railroad or by flume can

be handled in this manner. With the elimination of the logging railroad, the fire hazard is greatly reduced. If truck roads are adapted by location and construction to local conditions they become nearly permanent, except for bridges, but there are two very different types of conditions which must be considered in road construction in this region. The great valley which separates the chestnut from the oak province likewise defines two types of conditions affecting road construction and maintenance. To the eastward are largely easily eroded micaceous soils with poor surfacing stone and a rainfall which is heavy, particularly to the southeast; to the west are more porous shales and sandstones for road foundation, and better road-surfacing material with less concentrated rainfall. In most of western North and South Carolina even well-graded roads not constantly dragged are ruined in a few seasons unless surfaced and provided with artificial means of caring for surface water. Not being ice-bound during the winter, they are subject to year-round deterioration. Roads through the shales which form a large portion of the country rock west of the great valley, even when steep, remain for years in very serviceable condition. The heaviest and most valuable stands of National Forest timber are to the southeast, and systems of roads should be designed looking toward the development of timber values and the ultimate betterment of these Forests. These stands are situated in the most remote and roughest sections and in the poorest communities and those less able to contribute to the cost of road construction. If the vicious principle obtains that only "to him that hath shall be given," then these sections offering the widest field of silvicultural promise must wait, with the possibility of piecemeal development in the same general manner which has already resulted in the lessening of the earning value of so large a proportion of the cut-over forest lands of this section. Every dollar invested in roads in this region will be more than returned in stumpage appreciation, besides affording the opportunity of forest betterment, the possibilities of which seem almost unlimited.

Stumpage values which have been given will not apply to the less accessible timber located on the upper slopes and ridges, especially where the stand is lighter; but, from the point of view either of exploitability or silviculture, this is not of moment. The greater portions of the value and volume are concentrated on about one-half of the area, and price conditions are now such that all classes of timber can be removed within this area. The desideratum of the American forester is rapidly being attained: Commercial reasons no longer need abso-

lutely dictate the policy in fellings. It is not necessary to sacrifice silviculturally a tree or group to insure operator's profit; it is possible further to require the removal of practically every tree without encroachment on profits. It is not intended to imply that the refinement of jardinage of western European practice can be applied; our costs of administration are too high and the value of stumpage is still too low.

The salient point is that at the present prices of timber it is possible, if roads are supplied permitting the general use of motor trucks, to adapt cutting to meet the broader phases of local silvicultural requirements, at least in the hollows where the heavy stands are concentrated. It opens an opportunity for the inauguration of practice to solve many of the basic silvicultural problems of the region: Determining the character of the replacement to follow chestnut as it is killed by blight (the recrudescence of the malady in southwestern Virginia seems to portend its extension into the heavy stands farther south, which are extremely valuable on account of their high tannin content) ; the more general dissemination of poplar, ash, northern red oak, basswood, and white pine; the eradication from certain forest types, or at least the reduction in proportion, of some of the low-grade species; and questions of increment and increased value. It is not too soon to look forward to a provisional decision as to the choice of species which should be given preference in the different forest types in the stands now being established, but which will not mature until after the end of this century.

For a long time the forest-land owner has been bombarded with a barrage of "protection propaganda." It is believed that with autotrucks and the portable band-mill it is now possible to make an affirmative showing of the profits in serial fellings. Such fellings would be designed to reduce operating costs in the first operation by neglecting small trees, and to secure for the benefit of future operations price increment for low-grade stock and accretion for young trees. It is believed that the time is now favorable for making an intensive investigation of these problems in connection with commercial operations, to demonstrate whether serial fellings on private lands are feasible with autotrucks as motive power, and thus keep abreast of changing economic conditions.

ACTIVITIES OF THE SOCIETY OF AMERICAN FORESTERS[1]

By F. E. Olmsted

President Society of American Foresters

Some twenty years ago, when the Society of American Foresters had its beginning, its membership included not more than a dozen names. By the end of the present year we shall have about five hundred members engaged in professional work in all parts of the country, and, if a liberal policy is adopted in admitting new members, the organization should grow much more rapidly from now on. I decidedly favor a liberal policy in this respect, believing that the more democratic we become the greater will be our strength and influence.

Here is a professional group of men capable of doing much for the advancement of forestry. In the past, as I see the matter, the Society of American Foresters has largely failed to take advantage of its opportunities for expressing its opinions on questions of vital importance in forestry and for leading public sentiment along favorable channels. We have accomplished much, of course, through open discussion of technical problems; but we have for the most part refrained from taking part in the every-day problems which confront the profession of forestry from one end of the country to the other. By this I do not mean to infer that the Society should turn itself into a machine of a political or propagandist nature. Far from it. I do mean, however, that the Society should take a lively interest in all of the common problems relating to the standing and progress of our profession, and I feel strongly that in case we fail to do so we should not only miss many an opportunity for real accomplishment, but also fail in our plain duty to the public. I should like to see the Society concern itself very directly, although from a strictly professional standpoint, with all forestry problems of municipal, State, or nation-wide importance. We should become an active as well as a deliberative organization.

With this object in view an attempt is now being made to put life into our work. The biggest task before us is that of applying forestry to privately owned timber lands. The Society of American Foresters

[1] Paper read at the meeting of the Northeastern Foresters' Association, Mt. Kineo, July, 1919.

should discuss this question from every conceivable angle; but it should by no means limit itself to discussion. It should propose a plan of action representing the opinion of the professional foresters of the country and should assist in making this plan effective. To aid in bringing this problem to a focus, a committee, with Gifford Pinchot as chairman, has been appointed. This committee will suggest a course of action for consideration by the Society, and its program, along with others proposed, will be placed before the members for approval by letter ballot. Let me say here that there should be no difference of opinion among foresters or lumbermen as to the ends at which we aim. These ends are clear. There remain for discussion and decision simply the means through which these ends may best be reached, and the Society of American Foresters should be able to suggest a definite and practicable course of action.

A joint congressional committee is now engaged on a reclassification of salaries, and action taken upon the recommendations of this committee will affect not only the salaries of foresters in the Government service, but also, because of the fixing of certain standards, the salaries of those in State, municipal, and other employ. This committee is seeking advice from representatives of recognized scientific organizations, and the engineering societies have already sent delegates to Washington. Austin F. Hawes has been appointed as the representative of the Society of American Foresters and has been accepted by the committee as adviser on Forest Service salaries.

Other committees already at work or in process of formation are those on Business Organization, including the circulation of the JOURNAL OF FORESTRY; Information, Publicity, Forest Insurance, Forest Leases, Forest Loans, Forest Taxation, Proposed Union of Scientific Workers, and Forestry Classification.

Of particular interest, I think, is the improvement shown in the JOURNAL. During the past few years it has developed into a very live and highly interesting publication, and in my mind its editors deserve the greatest credit. The profession of forestry may be advanced in a substantial way through a much wider circulation of the JOURNAL, and foresters should give it their utmost co-operation and encouragement.

I have touched upon these matters simply to indicate that the Society is beginning to look not upon a somewhat broader horizon and is attempting to make itself felt as an instrument of progress in forestry. In this very connection I should like to urge the formation of a section of the Society in New England, or in the Northeast. Let me say that on

no account should I care to see the excellent work of the Northeastern Foresters' Association interfered with; but I should like to suggest for your consideration the possibility of organizing a section of the Society which, perhaps, might live on amicable terms with your present organization and supplement its work. It is needless for me to tell you that the next few years bid fair to be crucial ones for forestry in the United States. I am convinced, too, that the Society of American Foresters should and will play an important part in the coming struggle. All our nine sections are now engaged in discussing the possible application of forestry to privately owned timber lands in their own localities. New England and the Southeast are the only regions where the Society is not represented by local organizations, and the foresters of the Southeast have informed me that they will favor the formation of a local branch next fall.

Without question, the Society as a whole would be decidedly strengthened by the addition of a New England, or a Northeastern, section, for then it would have an official part of itself to whom it might look for guidance and advice on the many vital forest issues in this territory.

It might also come about that a local section would result in tying Northeastern foresters more closely with foresters and forest problems in other parts of the country and with the national movement as a whole. May I ask that you think it over?

PATHOLOGICAL MARKING RULES FOR IDAHO AND MONTANA

By JAMES R. WEIR, *Forest Pathologist,* and ERNEST E. HUBERT, *Scientific Assistant*

INTRODUCTION

From the standpoint of forest sanitation the marking of trees in the administration of timber sales is fundamental. No other stage in the timber-sale operation offers better opportunities for the practice of such principles as will result in checking the spread of forest-tree diseases. Everything consistent with existing economic conditions should be done to reduce the chances of infection of the present timber crops in every stage of their development and to insure, so far as possible, a healthy reproduction. In order to do this, it is important that the marking rules should be so formulated as to exclude all but thrifty and healthy trees for the left-over stand and for seed trees. Attempts should be made to apply specific disease-prevention rules for marking to the various forest types of Idaho and Montana, so far as is consistent with economic limitations and the systems of cutting. It is believed that efforts should be made so far as practicable to have the Forest Service take over entirely the execution of all forest sanitation work and leave as little as possible in the hands of the purchaser.

This paper attempts to formulate such rules for definite types and systems of cutting common to the National Forests of Montana and Idaho, so far as conformable to practical application.

THE OBJECTS OF MARKING

The principal objects of marking in Forest Service timber-sale operations are silvicultural in character. They are intended to secure a maximum cut without overlooking the necessary steps toward a future crop of maximum volume and quality. In order to fulfill the latter object, it is highly important to reduce the amount of unmerchantable material in the stand caused by fungi and other deteriorating agents and to prevent loss of desirable reproduction. For these reasons all marking regulations should contain specific instructions regarding the cutting of all disease-infected trees, whether below the diameter limit

or above. The objects of marking for the western white pine type, including the one concerned in the health of the forest, are given as follows:

1. To secure a second cut (or cuts) from stands already established.

2. To harvest the crops and establish a new stand, and to secure the benefit of increased growth on any trees which may be left.

3. To reduce the proportion of undesirable associate species to a minimum, or at least to a point where they will not interfere with the reproduction and growth of the more valuable species.

4. To reduce or attempt to eliminate forest-tree diseases in the stand, and in so doing increase the health of the stand and the production of sound timber. To prevent the loss by rot of trees left standing on an area. To prevent the loss by windfall due to fungi of valuable seed trees before the area is properly reseeded.

Sections 1, 2, and 3 are taken from the Forest Service marking rules for western white pine.[1]

Before proceeding further with a discussion of the application of the above objects, it will be of value to emphasize the need of forest sanitation in our forests, or at least in certain portions of them where the economic conditions will permit of the additional cost.

THE NEED OF FOREST SANITATION

Forest sanitation is the means by which a proper degree of forest hygiene is attained in respect to forest-tree diseases in certain stands of valuable timber. Forest sanitation is a means to an end, and forest hygiene is the ultimate goal. Certain stands are specified because at the present stage of forestry in the forests of the Northwest intensive methods of disease control are out of the question for any considerable portion of the vast forested area. Meinecke,[2] Weir,[3] and others[4] have expressed this idea in discussions of forest pathological problems. Forest sanitation under present conditions must, therefore, be restricted in its application to Forest Service timber sale areas or similar operations by private operators, and only to those where the method of cutting and economic considerations allow of any measure of control. Aside from the above, certain general rules aimed at reducing the chances of infection may, however, be observed at all times on any area where forest improvements are made. The methods by which forest sanitation is best attained are methods which have to deal principally with the elimination of standing undesirable trees and the disposal of

unmerchantable portions of cut, diseased trees, and all other infected slash on sale areas.

In starting out to show the need of forest sanitation a brief discussion of the principal factors concerned in the infection of trees by various disease-producing agencies is necessary.

Wood-rotting fungi are capable of producing sporophores following the death of the host, and in such cases as *Trametes pini* there are often more sporophores produced on the fallen host in most forest types of the Northwest than at the time the host was alive. These factors are important from the viewpoint of leaving infected slash and infected snags and live trees on cut-over areas where they may develop innumerable fruit bodies and by the liberation of large masses of spores threaten the health of susceptible trees. It has been determined by Buller[5] from partial counts that an average of 1,700,000 spores were produced from each pore on the lower surface of *Polyporus squamosus*, or a total of more than eleven billion for the entire lower surface, which had an area of 38.75 square inches. He also states that a sporophore of the same fungus kept under observation continuously gave off clouds of spores during a period of 13 days. A million spores a minute for two or more days were recorded. These spore clouds may be observed under certain conditions in the forest. Buller further states that the number of spores produced by a single specimen of this fungus may in the course of a year be some fifty times the population of the globe. This gives some idea of the enormous number of spores set free from sporophores developing upon infected trees and infected slash found on cut-over areas. Although no counts have been made of the spore production of some of the most harmful Polypores, yet there is no reason to believe that they will fall much below the figures given above. The sporophores of *Trametes pini, Polyporus schweinitzii,* and *Echinodontium tinctorium* produce spores over a considerable period of time during the favorable part of the season. In the case of certain fungi which sporulate during the early part of the season, spore production is renewed again during the fall rainy season. Some of our most destructive tree fungi show extreme hardiness to low temperatures and will grow and produce spores during winter weather, and abundantly with the first return of favorable conditions. The enormous number of spores produced depend principally upon air currents for their distribution to susceptible host trees. In this connection an open stand lends itself to a greater distribution of the spores than a closed one. A dense stand through which horizontal air currents are

drifting and carrying spores will act as a screen and prevent the deep penetration of a large number of the spores; also many spores will fall on unsusceptible hosts. An open stand will allow freer circulation, less obstruction, and therefore a greater distribution of the air-borne spores. Spores liberated from elevated points are carried long distances by air currents, but few sporophores are produced on hosts in such exposures compared to the number produced in the more moist and shaded valleys and canyons.[6] In the mountainous regions the diurnal changes in temperature cause changes in the direction of air currents. These currents, which usually flow along the earth's surface, cause a distribution of the spores in opposite directions from the source.

Other factors in the chances for infection are found in the earliest infection age of the trees, the number of injuries in the tree susceptible to infection, and the age of the tree, since the risk of infection increases with increased age. It has been found that certain tree species have definite ages at which earliest infection is most likely to take place. This age of earliest infection for western white pine infected with *Trametes pini* and *Polyporus schweinitzii* is approximately 50 years.[7] This information is important in respect to determining when the young stand first becomes susceptible to infection. The formation of susceptible heartwood and the presence of branch stubs contribute to the chances for early infection, as well as for subsequent infection. Branch stubs, fire scars, frost and lightning cracks, blazes, and all other injuries are the principal paths of entrance for heart-rotting fungi. Some of the numerous spores carried by air currents find lodgment in the crevices of a branch stub or a fire scar, and there germinate. Mycelia develop and enter the heartwood of the tree wherever dead tissues are found to bridge the live and resistant sap region. Some of the parasitic fungi, such as *Armillaria mellea,* apparently do not require the bridge of dead tissue, but attack the live tissues of young roots and enter in this manner, although injuries causing openings in the trunk or roots would, no doubt, assist in a more rapid and more virulent attack.[8] The trees selected to remain upon the sale area are in the nature of a thinned stand. In the Whitman National Forest it was found that thinning promoted the development of the larch mistletoe in the crowns of the host. These infections were found to be a menace to the surrounding trees of all age classes.[9] It is evident that trees left upon a cut-over area and receiving injuries during the process of logging are thus made more susceptible to infection by spores of fungi,

and the mistletoe development is favored by the thinning. The logging process, if it does not cause direct mechanical injury to the bark of the standing live trees, is bound to cause an increased number of branch stubs by the breaking of dead and living branches on such trees. Another factor of importance is the development upon a large number of different host species of a single species of fungus. This is believed to be true so far as investigations have progressed. For instance, *Trametes pini,* one of the most destructive of wood-rotting fungi, is found attacking practically every conifer in this region. *Polyporus schweinitzii* and *Fomes annosus,* two very destructive fungi, are found attacking a number of different hosts. *Echinodontium tinctorium* and *Poria weirii* are about the only destructive fungi which are restricted to specific hosts. The former is of economic importance only on the hemlocks (Tsuga) and true firs (Abies), the latter on Thuja. The indiscriminate attack of such a fungus as *T. pini* upon a large number of hosts emphasizes the possible dangers to susceptible trees by the unchecked production of the sporophores of this fungus.

Since fungi attacking reserved seed trees weaken the resistance of such trees to the action of wind, the loss by windfall and wind breakage of valuable seed trees before the area has been properly reseeded should be prevented by selecting only such seed trees as are free from all root, butt and trunk rots.[10]

THE PRACTICAL APPLICATION OF PATHOLOGICAL MARKING RULES

Information for the Marking Officer

In order to fulfill completely the object of hygienic marking and to secure the greatest returns upon the investments in National Forests, the marking officer should possess a working knowledge of the pathological conditions which will confront him in the routine of marking. It is not necessary that he become a technical pathologist, but he should become familiar with certain signs or symptoms of the various tree diseases and should be able to judge approximately the extent of decay in a tree, once it is determined the tree is attacked and the casual fungus known.[11]

The successful application of the pathological marking rules by the marking officer depends upon the following points:

1. The recognition in the forest of the outward signs and symptoms of the various diseases of standing living trees.

This entails a working knowledge of the principal disease-producing organisms found attacking the timber trees of this region. The presence of "punks" or "conks," the fruiting bodies of fungi, the presence of punk knots, pitch flows and swellings at the branch whorls, and stag heads on older trees killed by fungi or mistletoe are all included as diagnostic characters indicating the diseased condition of the tree.

> 2. A fairly accurate judgment of the extent of rot in each tree found attacked by wood-rotting fungi and a knowledge of the amount of damage done and to be expected from other important tree diseases, such as rusts and mistletoes.

Tapping the trunk of the tree with any blunt instrument in order to determine whether the tree is sound or rotted, and the extent to which it is decayed, is one of the most reliable methods when no fruiting bodies or other symptoms are present. Good practice can be secured by applying the test to doubtful trees and later checking the conclusions by examining the identical trees after they have been cut. The extent of rot up the trunk, the difference between sound and slightly infected trees, as well as the identification of the various kinds of rots, can be determined by the above practice.

> 3. A knowledge of the age of first infection of the various species of trees found in the stand. (The use of data collected by the Office of Forest Pathology on separate tree species[4], [7].)

Knowing the age of earliest infection for a single tree species occurring upon a given site, the marking officer knows how early in the age of the stand to expect decay. From this age on infection in the stand is to be guarded against, and as the stand becomes older this danger increase. By knowing the age classes of the trees to be marked in the stand and applying the knowledge secured from rot studies made of similar species and age classes[2], [4], [7], a good idea of the pathological condition of the stand may be had. This knowledge can be applied to the marking practice. For *Echinodontium tinctorium* attacking western hemlock, the average age of first infection for the river-bottom type is approximately 44 years, and for the slope type 57 years;[4] this for the Priest River region.

In the case of western white pine, for all the principal rots found in the stand, an age of earliest infection of 50 years was determined for the tree in general. These data are from the Cœur d'Alene National Forest. The principal fungi attacking this tree in order of their

importance are *Trametes pini, Polyporus schweinitzii,* and *Fomes annosus.* The rots in the western white pine studies were classed under two heads, viz., butt rot and trunk rot. These two were combined in securing the above infection ages. The main trunk rot fungus is *T. pini.* *P. schweinitzii* and *F. annosus* were both included as causing butt rots.

It will be found helpful to list under each tree species the most important fungi to be encountered in the various forest types of this region. Accordingly, Table 1 has been prepared for this purpose. The fungi-causing diseases are listed in the order of their importance, and the common names are given following the first mention of each fungus species. For further information see U. S. Department of Agriculture Bulletin No. 658, listed in the bibliography.

Provisions are made in timber-sale contracts for the removal of all merchantable material between specified diameter limits. Logs of the more valuable species scaling 33⅓ per cent of the gross scale sound and 50 per cent in the case of logs of inferior species are removed by the purchaser. In many contracts a special clause requires the purchaser to cut and utilize the merchantable portion of "all living and dead defective trees which, in the judgment of the forest officer, contain one or more merchantable logs scaling one-fourth of the total volume of the tree." (Standard clause 21.)[12]

Such requirements, which are more in the nature of close utilization clauses than sanitation clauses, take care of a considerable number, if not the majority, of infected trees upon the sale area. The infected trees which are both above and below the diameter or cutting limits and those which are entirely unmerchantable and are not required to be cut under the contract are the trees which concern us most in this discussion.[9] The object of this paper is to provide for the cutting of *all* infected trees which may be considered dangerous if left upon the sale area. If the marking rules satisfactorily provide for this object, then the further removal of the infected slash left upon the area after logging can be considered under another operation—that of brush disposal.

In discussing methods and means for the cutting of all unmerchantable infected trees, it is well to consider the part played by the purchaser. Standard sanitation clauses in timber-sale contracts ordinarily place the burden of execution upon the purchaser, who in most cases does not see the justification for these special provisions and therefore is not conscientious in carrying them out. For this reason better results will be obtained if the Forest Service assumes directly the expense of the sani-

tation work, enforcing the application of pathological marking rules and so far as practicable carrying out the operation of cutting the infected unmerchantable trees. But there are certain factors which prevent such a plan being executed, especially in the operation of felling such trees. The cutting of these trees by Forest Service crews is practicable only up to the point where a large number of trees need to be cut, and under such conditions it is undeniably cheaper to fell them at the time of the logging operation, using the woods crews for the purpose. Infected trees below the diameter limit and a small number of the larger infected trees could be felled by the brush crews at odd times, when brush burning is inadvisable or impossible, due to weather conditions, providing such an operation were permissible under brush disposal. The only drawback to a plan wherein the purchaser deposits a sum to cover the cost and the Forest Service takes over the entire operation of cutting and disposing of unmerchantable infected trees is the stipulation, under brush-disposal regulations, which apparently cannot be made to include the cutting of standing trees. A portion of the congressional act of August 11, 1916, referring to timber sales is as follows:

"That hereafter deposits may be received from timber purchasers . . . to cover the cost to the United States of disposing of brush and other debris resulting from the cutting operations in sales of National Forest timber."

If the term "debris" could be interpreted to include unmerchantable infected standing trees, then the way would be clear, and the entire operation of cutting these trees and disposing of them would be absorbed by the brush-disposal work. Difficulties would also be met with in cases where large numbers of infected trees were to be cut, and the cost of carrying out a second cutting on the area would not be justified.

Apparently the use of a standard sanitation clause is the only method which will fit in with the plan of the disposal with the brush of all cut infected trees. This clause should specify the cutting of all trees marked by the forest officer, and should deal particularly with unmerchantable infected trees within the diameter limit, as well as those below the diameter limit. It should be clearly understood that only those infected trees considered dangerous to leave upon the area are to be cut under this clause. In the appraisal the stumpage price can be reduced sufficiently to cover the cost of felling such trees. The Forest Service in this way ultimately pays for the sanitation measures put into effect,

both in the operation of felling and in the operation of disposal of infected unmerchantable trees or parts of such trees. The pathological marking rules will be useful as a guide in the appraisal of each sale area. The amount that can be expended for forest sanitation can be computed with these rules as a basis, modified by such economic factors as are present. The marking can then be carried out according to the stipulations in the appraisal. The aid of men thoroughly familiar with forest sanitation work should be employed in outlining definite pathological marking rules for individual sales.

The Western White Pine Type

Recently, in the formulating of marking rules by the Forest Service in District 1 (Montana District),[1] a classification of western white pine stands has been made, under two main heads, A and B, having two subheads under A and three under B. The A stands contain a minimum of about fifty trees per acre, between 6 and 14 inches d. b. h., thrifty trees, suitable to increase in growth after a cutting and exclusive of hemlock and defective trees of other species. The A_1 stands contain practically all trees below 14 inches d. b. h. The A_2 stands contain sufficient trees over 14 inches d. b. h. to justify a logging operation. The B stands contain less than about fifty trees per acre, as described above, and the B_1 stands are those in which small trees of desirable species between 6 and 14 inches d. b. h. occur frequently. The B_2 stands contain practically no small trees, but contain thrifty trees, including some white pines, capable of living through a second rotation. In the B_3 stands there are no white pines evidently capable of living through a second rotation.

In general the A_1 and A_2 stands are managed so as to secure a second cut from the trees already established. This is secured by improvement thinnings and partial cuttings. The B_1, B_2, and B_3 stands are managed so as to harvest the crop and establish a new stand of white pine and other desirable species. Reproduction cutting and clean cutting are the methods proposed to secure this result.

With this outline in mind and taking into consideration the various factors concerned in the infection of trees previously discussed, it is readily seen that on A_1 and A_2 stands, where a second cut is expected from the trees already established, there is a greater need for forest sanitation than on any of the B stands. In the A stands the reserved growth may be approaching the infection age, and no diseased trees should be left upon the area to menace this future crop.

In B_1, B_2, and B_3 stands where reproduction on clear cutting with seed trees is proposed and the only trees left upon the area are the seed trees, mistletoe and rust infections are probably the only danger to young growth to be guarded against. The marking rules should provide for the cutting of all mistletoe and rust-infected trees upon the sale area, and in this manner eliminate the danger. The importance of the cutting of trees infected with heart-destroying fungi on such areas is not so great as upon the A_1 and A_2 stands, since it would take about 50 years for the reproduction (white pine) upon the area to reach the earliest infection age.[7] The question of seed trees left upon the B stands is an important one from a pathological point of view. Seed trees attacked by wood-rotting fungi not only act as centers for the spread of diseases which threaten reproduction and sound mature trees, but also subject the trees to early wind-breakage through the weakening of the trunks and to early windfall through the weakening of the roots. If the seed trees suffer windfall or wind-breakage at an early date, before they have had time to properly reseed the area, then this loss is sufficient to justify methods of prevention. In such stands as the B_3 where there are no white pines evidently capable of living through a second rotation (100-120 years), care should be exercised in the selection of seed trees. Veteran trees having defects other than rot, rust, or mistletoe, unless such defect greatly weakens the resistance to wind-breakage or windthrow, may be selected as seed trees, if thrifty and healthy seed trees cannot be had without such defects. Veteran white pines showing indications of rot, but without visible sporophores, should be the last choice for seed trees in case no sound trees can be found to serve the purpose. In any event, trees with visible live sporophores should not be selected for seed trees, and the tendency should always be toward sound trees in the case of seed trees other than white pine. Even though an infected veteran seed tree should not live over until the reproduction reached the infection age, the damage done by allowing it to remain, develop sporophores, and spread the disease to near-by susceptible trees should be sufficient to condemn such a practice. The recommendations for pathological marking on the western white pine type resolve themselves into two main divisions: (1) those applicable to the selective method of cutting or improvement cuttings, and (2) those applicable to the clean-cutting method. The first method covers the A_1 and A_2 stands, while the second method covers the B_1, B_2, and B_3 stands. The recommendations are as follows:

For the A_1 and A_2 stands: Designate to be cut all trees of whatever

species, whether merchantable or unmerchantable, found infected with wood-rotting fungi, rust, or mistletoe. Diseased trees menacing young growth and sound mature growth should be designated to be cut.

For the B_1, B_2, and B_3 stands: If, under the clear-cutting system, there are any trees left standing other than seed trees, designate to be cut all trees of whatever species, whether merchantable or unmerchantable, infected with rust or mistletoe, in order to protect the reproduction.

In marking seed trees to be reserved on the area after cutting, only those free from root, butt or trunk rots, and from rust and mistletoe infections should be selected. This is to prevent premature loss of seed trees by windfall or wind-breakage and to prevent the spread of rust and mistletoe infection. Thrifty and healthy seed trees should be selected in preference to all others, wherever possible.

Mature or veteran trees having defects other than rot, rust, or mistletoe, unless such defect greatly weakens the resistance to wind-breakage and windthrow, are recommended to be left as seed trees.

Mature or veteran trees showing indications of rot, but without visible sporophores, should be the last choice for seed trees, in case no sound trees can be found to serve the purpose. Veteran trees of very old age will rarely live through the second rotation, and most of them will be past the sporophore production period by the time the reproduction has developed the infection age.

The Larch-Fir Type

Marking rules for the larch-Douglas fir type have been issued by District 1 of the Forest Service for guidance in drawing up specific rules for individual sales.[13] These rules give the classification of the type under two main heads: I. All-aged stands; II. Even-aged stands. The subdivisions under each of the above heads are as follows:

1. Immature, with some merchantable timber and considerable material of tie size—that is, 13 to 17 inches d. b. h.
2. Mature.
   - (*a*) With more than 50 trees per acre below merchantable size.
   - (*b*) With less than 50 trees per acre below merchantable size.

The marking for I (all-aged stands), II, 1, and II, 2 (*a*) stands provides for a selection cutting, which will leave more than 50 thrifty sound trees 6 inches and over d. b. h. per acre. The marking for II, 2, (*b*) stands provides for clear cutting with seed trees. In respect to the

systems of cutting employed, this type is somewhat similar to the western white-pine type. Both are managed by two systems, selection or improvement cutting and clear cutting. The objects in view in the marking practiced on the two types differ somewhat, but, so far as the application of pathological marking is concerned, no great differences result. Similar marking regulations as recommended for the two methods of cutting in the white-pine type are applicable to the two methods of the larch-fir type.

The Engelmann Spruce Type

The principal tree of this type, the Engelmann spruce, is a tree which is quite susceptible to a number of destructive forest-tree diseases.[11] some of which are apparently confined to the species. The fact that the environment in which the tree grows is favorable to fungous development makes the problem of hygiene in this type more difficult. A shallow root system and the common occurrence of root and butt-rotting fungi makes this tree subject to windfall. Heavy thinnings and scattered seed trees are, therefore, dangerous in this respect. If the methods of cutting in this type aim to produce pure or nearly pure future stands of spruce, then there is the greatest need for the application of marking rules which will ensure healthy, wind-resisting seed trees and will protect the future crop from the various diseases. If the spruce cutting is in the western white pine type of stand and white pine is favored in the second rotation, then the treatment in regard to marking would be the same as for the white-pine type classifications and dependent upon the cutting methods employed. In the spruce type clear cutting or strip cutting would appear to be the best method to apply, in view of the nature of the principal tree. Strip cuttings are clean cuttings on a smaller scale, and in definite-shaped areas and so far as pathological marking rules are concerned can be included as clean cuttings. If the clean cutting method is used in a pure or nearly pure stand of spruce, nothing but a spruce reproduction is to be expected. If spruce seed trees are reserved upon such areas, it is highly important that these trees be absolutely sound, free of all disease, in groups, and left upon sites other than wet flats; the last for the reason that a common root fungus, *Poria subacida,* is apt to be more vigorous on low, wet ground. Another reason for not leaving seed trees on soggy or poorly drained soil, and which may apply to other trees as well, is that the tap-root is frequently found decayed and the tree is easily overthrown by the wind.

Special care should be taken not to leave spruce infected with rust as seed trees, since this fungus, which is easily recognized by the deciduous brooms produced, frequently attacks and damages the reproduction. The seat of infection is very often on the main shoot. Since all trees upon the area excepting the seed trees will be cut, there is no need for marking rules other than the ones recommended for the seed trees.

The Lodgepole-pine Type

Mason[14] gives two principal objects of lodgepole-pine management, and as a means of attaining these objects discusses the various methods of cutting to be applied. Clear cutting is recommended for overmature stands, and the group-selection method for mature stands. Improvement thinnings are applied to young stands. In many of the operations in the lodgepole-pine belt, especially in the Deerlodge National Forest, close utilization makes it easier to recommend the cutting of all defective trees. The character of the material utilized, along with the market demand, makes it possible to sell timber which would not be considered merchantable in sales of other species or of lodgepole in other localities. Stulls, mine props, converter poles, lagging, fence posts, ties, and cordwood are the principal uses for the wood cut, and such material too defective for use in one class can be used in another. A large amount of defective material (barring rotted wood) is utilized as cordwood. This favors the cutting of all diseased trees, whether merchantable or unmerchantable, upon the sale area and insures a healthier stand for the next rotation. The fact that lodgepole is the principal reproduction on sale areas in the lodgepole type makes it doubly important that the future crop be protected from all diseases distributed by the trees of the old stand. It is, therefore, necessary, where clear cutting with seed trees is applied, to select seed trees which are free from all root, butt, and heart rots, rust, and mistletoe, in order to prevent the spread of disease, the infection of the adjacent young stand, or the reproduction and to minimize the chances of loss by windfall. In the group-selection cutting, the danger by windfall should be guarded against, and the trees left upon the area should be selected with this point in mind. Wherever reproduction or young growth not yet at the infection age is intended to be left on the area after cutting, care should be taken, as a protective measure, to mark all diseased trees to be cut. Particular attention should be given to mistletoe-infected trees, since this parasite is usually very abundant in most of the southern Montana forests and is principally confined to lodgepole pine. The mistletoe of

yellow pine very rarely attacks lodgepole, and the species on Douglas fir not at all. These two parasites should be considered wholly in relation to their specific hosts when occurring in the lodgepole-pine type. The rusts of lodgepole are also chiefly confined to the species and should be considered chiefly from the standpoint of injury to reproduction. If reproduction is infected, mature, full-sized trees will not result. The infection of older growth may or may not interfere with the economy of the situation.

The Western Yellow-pine Type

The western yellow-pine type usually occurs upon sites which are drier and more open than the other types discussed, with the exception of the lodgepole-pine type. Nevertheless, considerable heart rot is found in the western yellow-pine type. This is true in the more moist or higher stations of the type where it becomes associated with Douglas fir. With the increasing density of the mixture, the yellow pine becomes more defective, due in part to the introduction, into the formation, of diseases usually associated with Douglas fir. Heavier marking should be practiced under such conditions. Mistletoe (*Razoumofskya campylopoda*) attacks the principal tree of the type and causes considerable damage in certain localities, the young growth suffering the most damage. The pine rusts (principally *Cronartium pyriforme* and *C. filamentosum*) are very common on yellow pine, causing damage and death to the branches of mature trees and killing young growth by the formation of large galls and cankers.

Even before the cutting, the openness of the stand in this type, no doubt, aids in the suppression of sporophore production. Yet this same openness allows of a freer and wider distribution of the spores, once they are formed, and, the stand being more or less pure, the spores will fall on susceptible hosts. The stand left upon the area for a future cut should be given every chance to develop a maximum of sound material, and this can only be brought about by safeguarding the trees left upon the area and preventing their infection. Diseased trees capable of producing fruiting bodies of any of the various tree diseases (rots, rusts, or mistletoes) should not be left as part of the stand reserved for a future cut. These diseased trees, if left standing, will prove a means of distributing the diseases, and the infection of sound young trees will result. Since the majority of sales in the western yellow-pine type in this region are managed under some form of selection cutting, recommendations for pathological marking on such areas are identical with

those recommended for similar methods of cutting on other types of forest in this region and previously discussed.

TABLE 1.—*Host Index*

(See also U. S. D. A. Bulletin No. 658)[11]

Western white pine (*Pinus monticola*).
- Trametes pini (ring-scale fungus).
- Polyporus schweinitzii (Velvet-top fungus).
- Fomes annosus (root fomes).
- Armillaria mellea (honey mushroom).

Western yellow pine (*Pinus ponderosa*).
- Trametes pini.
- Polyporus schweinitzii.
- Fomes laricis (chalk fungus).
- Cronartium filamentosum (pine rust).
- Cronartium pyriforme (pine rust).
- Cronartium sp.
- Razoumofskya campylopoda (yellow-pine mistletoe).

Lodgepole pine (*Pinus contorta*).
- Trametes pini.
- Polyporus schweinitzii.
- Cronartium filamentosum (pine rust).
- Cronartium pyriforme (pine rust).
- Cronartium sp.
- Razoumofskya americana (lodgepole-pine mistletoe).

Western larch (*Larix occidentalis*).
- Trametes pini.
- Fomes laricis.
- Polyporus schweinitzii.
- Polyporus berkeleyi.
- Razoumofskya laricis (larch mistletoe).

Douglas fir (*Pseudotsuga taxifolia*).
- Polyporus schweinitzii.
- Trametes pini.
- Polyporus sulphureous (sulphur fungus).
- Razoumofskya douglasii (douglas fir mistletoe).

Engelmann spruce (*Picea engelmanni*).
- Trametes pini.
- Polyporus schweinitzii.
- Poria subacida.
- Fomes annosus.
- Melampsorella sp. (spruce rust).
- Melampsoropsis pyrolae (spruce-cone rust).

Western red cedar (*Thuja plicata*).
- Poria weirii (brown-cedar poria).
- Polyporus schweinitzii.
- Trametes pini.

Western hemlock (*Tsuga heterophylla*).
Mountain hemlock (*Tsuga mertensiana*).
- Echinodontium tinctorium (Indian-paint fungus).
- Fomes annosus.
- Razoumofskya tsugensis (hemlock mistletoe).

Grand fir (*Abies grandis*).
- Echinodontium tinctorium.
- Fomes annosus.
- Razoumofskya douglasii.
- Pholiota adiposa.

SUMMARY

This paper presents the urgent need of forest sanitation in most of the timber sales conducted in Idaho and Montana, with special reference to the western white-pine type of forest. The rules are intended to cover the removal of all infected trees upon the area which, if left, would act as a menace to the remaining or future stands. Special at-

tention is drawn to the removal of infected trees below and above the specified diameter limits—a phase of the work heretofore receiving little attention. The practical application of such rules to the various forest types of the region is discussed along with methods and means of enforcing them. A plea is made to have the Forest Service carry out, so far as is practicable, all phases of the forest sanitation work.

As an economic measure, pathological marking rules, if properly outlined and enforced, will eventually insure a cleaner, healthier second crop, and by this means greatly reduce the loss due to decay.

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MECHANICAL AIDS IN STEM ANALYSIS

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All foresters are confronted with the monotony of stem analysis, both in the field and in the office, but the work must be done if one undertakes to manage a forest. The purpose of this article is to make suggestions for lessening the labor connected with stem analysis, especially office computations. These suggestions are based on experience in cordwood and tie operations in the Ozark region of southern Missouri.

The principal measurements required in the field are: stump height, length of each section used, length of tip, the diameter, bark thickness, and radius of decades counted from the bark to the pith at each cross-cut.

For measuring lengths, graduate the back edge of the beam of the calipers, the graduations increasing toward the fixed arm. The beam may then be used to measure all lengths with sufficient accuracy. When cordwood or ties are being cut, the sections are uniform as to length, so that the used length is determined by the number of sections. Only the stump and tip need be measured to determine the total height.

Since the bark is more or less broken by the saw on many cuts, it is advisable to measure the diameter outside the bark with calipers, taking the average of two measurements made at right angles. Measure the diameter inside the bark in the same manner, using a steel rule. If the rule is furnished with a sharp point at one end, stick the point in the pith and swing the rule around to the average radius and draw a line along the edge; then count the rings from the outside in and measure from the inside out. A fairly strong magnifying glass is of considerable assistance in counting the rings on slow-growing trees, such as post-oak and black-jack oak.

A 20-inch slide-rule and an adding-machine are two very important assistants in the office.

Suppose the total volume of the tree is desired in cubic measure. The formula, $B_1h_1 + \left(\frac{B_1}{-2} + B_2 + B_3 + \quad . \ . \ . \ . \quad + \frac{Bn}{2}\right)h_2 + \frac{Bnh3}{3}$

is readily solved on the adding-machine or on the slide-rule and adding-machine combined. There are three operations: First, work out the parenthetical quantity on the machine. Second and third, calculate the stump and tip volumes with one setting of the slide-rule for each, for either the Bn or h_3 may be divided by 3 mentally. For example, on a cordwood operation with 4-foot sections, take the basal areas from a table such as that in the Appendix of Graves' Mensuration. List these values in turn on the machine and take a subtotal. Then, with the repeat key on, pull the lever twice after setting up the subtotal; then once and take another subtotal. This gives the used volume. It frequently happens that the stump height is .5, .75, 1.0 foot, or some other fraction easy to handle. If so, the stump volume is obtained mentally and set in the machine. Otherwise, set the basal area on the D scale of the slide-rule, set 1 of the C scale over it, and under the height of the stump on the C scale read the volume on the D scale. The volume of the tip is obtained similarly and added.

If one wishes to correlate age and diameter or height and diameter, the ordinary method is to arrange the sheets according to diameter classes, transfer the values desired, average and then plot the average values. The listing, totaling, and averaging may all be done in one operation on an adding-machine. With a machine like the Burroughs or Wales, use the left side for one set of figures and the right side for the other set. Leave enough columns between the sides to take care of extra figures in the totals. The same work is performed by the use of the split-key device on the Dalton machine. By the use of a table of reciprocals, figure the averages. This is easily done on a Dalton. Then plot the averages in the ordinary manner.

If one wishes to determine the average rate of growth of an uneven-aged stand, the adding-machine is again helpful. The following method was used in an investigation made during the summer of 1918 on a cordwood operation where the second cut closely approximated the breast-high point:

First. Lay off a scale on cross-section paper twice as large as is desired for the finished graph. Let the horizontal scale be units of radius and the vertical scale units of radial growth for ten years, inside bark. The field measurements show that when a tree had a certain radius, the radius had increased to a certain length during ten years. Then on this first radius plot the increase; plot for each radius the corresponding increases; list and add the values; average and plot and draw in a finished curve; then convert the scale of the graph to diameter

by simply changing the values of the ordinates, so that the curve reads units of diameter growth during ten years for trees of specified diameters. It is not necessary to plot the individual points, for with a little practice one can list the two values of each point directly from the analysis sheets and save more than half the time required for the method as just outlined.

Second. Obtain the number of years required to grow one unit of diameter by taking the reciprocals (rounded off to the closest whole number) of each of the unit values of the above curve.

Third. Make the simple correlation of diameter breast high inside the bark with the double bark thickness, listing and adding the figures directly from the analysis sheets.

Fourth. Draw a curve—diameter breast high inside bark based on age. Lay off the horizontal axis in ten-year periods representing age on the stump and the vertical axis, units of diameter breast high inside bark. Begin the curve with a tree 0 units in diameter, plotting the point on the age required to reach the breast-high point (age taken from table of height growth based on age). Then on the ordinate, as many years to the right as are required to cause an increase of one unit in diameter, plot a second point. Plot the third point—two units of diameter—on the number of years required to reach this diameter. Then, above these points, plot the values of the double bark thicknesses (third). Read off the number of years required to reach specified diameters outside bark or rate of growth from the curve drawn through these last points.

The method has the advantage of showing the actual accomplishment of trees rather than assuming that growth in the future will be the same as in the past.

The averages required in Graves' modification of Mlodziansky's method are also handled easily on the adding-machine, either before or after plotting the individual points.

Another suggestion is that for scientific work volume tables in cubic measure can easily be constructed with relatively few measurements in the field if one uses a cone-form factor and a Dalton adding-machine. The work is similar to that described by Bruce for constructing volume tables by the frustum-form-factor method. The advantage of the cone-form factor is in saving time. The amount of time saved will depend on the sums of the digits in the factors. If the sums run less than 5, the method has an advantage; but if they are more than 5, there is none.

There are two types of keyboards on machines that add, those having nine rows of keys and the one having ten keys.

Calculating-machines and most adding-machines have similar keyboards and are of the first type. The calculating-machine simply requires the depression of keys to operate. They may be operated by the touch system if only the lower half of the keyboard is used. They are very rapid in multiplication and are fairly rapid in division. The chief objection to their use is that no record of the work is preserved. The Burroughs or Wales machines furnish a printed slip, but when used for listing two columns at the same time zeros are printed as well as the desired figures. It is difficult to use them for multiplication and division and to operate them by the touch system.

The simple ten-key Dalton machine commends itself to the forester, in that the touch system is readily learned and that the split-key device enables the listing and adding of the two columns *separately*. The repeat key and the 0 key make multiplication very easy and rapid. Sufficient accuracy is obtained in division by using a table of reciprocals. (Multiply the dividend by the reciprocal of the divisor.)

To sum up, the slide-rule takes care of fairly small numbers in multiplication and division and is very rapid. An adding-machine will list and add two columns at the same time, and whole pages of tables may be printed and totaled by shifting the carriage. The field is almost unlimited.

MENSURATION IN FRANCE

By Donald Bruce

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An unprecedented opportunity has been afforded by the Great War for American foresters and lumbermen to come to know the forests and the forestry of France. From this acquaintance much good undoubtedly will come. The object-lesson of a nation which, with its virgin timber supply exhausted centuries ago, could still meet such tremendous and imperative demands as those of the Allied armies with an adequate timber reserve will be salutary, and the exchange of ideas with the clear-thinking officers of the French "Service des Eaux et Forêts" will perhaps help us to see more clearly the objectives which we in America are striving to reach.

The following comments represent the impression made on one American forester by French mensuration:

The cubic meter is, of course, the standard unit of measure, and this is applied to both round products and lumber. Cordwood and the like is measured by the "stère" (a stacked cubic meter) or by several local varieties of the "corde." Both stère and corde may be dismissed with the comment that they are neither better nor worse than our own stacked-wood units. A slight increase in accuracy is obtained by the fairly common practice of separating cordwood into three more or less definite size classes: (1) *quartier,* or wood more than 5 inches in diameter, and hence big enough to be split; (2) *rondin,* or round wood between five inches and about 2 inches in diameter; and (3) *charbonnette,* or wood from two inches to one inch, and so called because often converted into charcoal. As a result, the actual wood content of a stère of any single class is more constant than where all are intermingled in varying proportions, as with us. This refinement is the logical outcome of high prices. (In certain regions beech cordwood sold for over $12.50 a cord, stumpage, even in 1917, before fuel prices had been much affected by war conditions.) It might be remarked, however, that on account of the disadvantage of the stère as a unit, many fuel-wood sales are made by the ton, with the degree of dryness covered by variations in price.

To return to the standard unit, the cubic meter, the measurement of the contents of a sawlog is usually by the Huber formula, which con-

siders it equivalent to a cylinder of the same length and a diameter equal to the diameter of the log at its middle point:

$$V = \frac{\pi}{4} D^2 L = .7854\, D^2 L = .0796\, C^2 L.$$

Computations are avoided by the use of tables which are very commonly based on middle circumference instead of diameter. The bark is usually included in the volume unless the log has been peeled. To distinguish the true volume thus approximately obtained from some of the results later to be described, the words "au réel" are generally appended.

The error of applying this method to long logs is of course recognized, and it is compensated in commercial transactions by modifications in the price paid per cubic meter.

There are, although no equivalent of this term is current, three "log rules" in common use. They are called "cubage au quart sans déduction," "cubage au sixième déduit," and "cubage au cinquième déduit." That they are in truth log rules is evident from their purpose, which is to give the volume of the sawed product of the logs. They are rules of the formula type and are one and all based on entirely erroneous mathematical principles. The formulæ are mere rules of thumb. They are:

Method	*Formula*
Au quart	$V = \left(\frac{c}{4}\right)^2 L = .0625\, c^2 L = .6168\, D^2 L.$
Sixième déduit	$V = \left(\frac{\frac{5c}{6}}{4}\right)^2 L = .0434\, c^2 L = .4284\, D^2 L.$
Cinquième déduit	$V = \left(\frac{\frac{4c}{5}}{4}\right)^2 L = .04\, c^2 L = .3948\, D^2 L,$

where V = volume in cubic meters, C = circumference, D = diameter, L = length, all in meters. The three forms of each formula show its origin, its simplest form based on circumference, and the same based on diameter. The "au quart" formula will be recognized as our "quarter-girth" rule, and the other two are merely more conservative expressions of the same type. The "au quart" formula actually gives the volume of a square timber cut from the log, but which will be slightly waney-edged at and above its middle point, the point of measurement; the "sixième déduit" that of a similar stick without wane, but with sappy edges, while the "cinquième déduit" gives that of a stick with neither

wane nor sap in the case of most species. None of the three takes account of material which can be saved from the portion of the log outside of these three cants, nor of waste in sawdust within the cant. All three, moreover, bear a constant ratio to the true cubic volume of the log, regardless of its diameter, and conversions from and to the same and from one log rule to another are possible by means of simple converting factors; for it is evident, from the formulæ already given, that:

Au réel: au quart: sixième déduit: cinquième déduit = .7854: .6168: .4284: .3948.

Figures "au réel" may be translated into "cinquième déduit," for example, by dividing by .7854 and multiplying by .3948, etc. There are many published tables based on these formulæ which eliminate all computations.

Which of these log rules is used in a given case depends, seemingly, on local custom, influenced by the amount of wane commonly permitted and the thickness of sap of the local species. Technically trained foresters generally quote figures "au réel."

It seems odd that such unsatisfactory rules should be current, but it should be remembered that under French conditions the errors involved are less serious than they would be with us. French timber is relatively uniform in size, wide variations in diameter are not encountered, and it is simple within a given "parcelle" to compensate the errors in the rule by the price paid. It is not encouraging, however, to those American foresters who advocate the exclusive use of the cubic foot of log, to the exclusion of the board foot, to see that France still clings to log rules far inferior even to ours. Only a real need for some expression of the amount of valuable product to be obtained from a log could have prevented the "au réel" formula from long since becoming universal.

Methods of estimating standing timber in France are far more standardized than with us. The field-work is laborious. It is almost always conducted by a party of four or five guards in charge of an officer who may be roughly equivalent to a forest examiner. The party works always together, the guards estimating or measuring diameters of every tree and calling them out to the officer, who tallies. Small trees are usually guessed, but a diameter tape is used freely for checking the larger trees. Diameters are taken in 5-centimeter or 2-inch classes or, very commonly, circumferences are recorded instead. The officer, in addition to tallying, takes the heights of enough trees to prepare a height curve for each "parcelle," and estimates either the form factor or the average taper. The crew works back and forth across each "parcelle" in strips until every tree is thus recorded.

The usual practice is to combine estimating with marking. In this case the officer also directs which trees shall be marked for reservation and of course tallies such trees separately. As this is usually done before the timber is put on the market, the would-be buyer can be furnished with data showing exactly how many trees of each diameter class are for sale.

Again, it must be borne in mind how different French conditions are from ours. The method appears at first sight expensive and with an uneven distribution of accuracy; but the expense of the complete diameter tally is reduced by the very low cost of guard labor, while the very uniform stands make the preparation of a height curve and the estimation of form factor or average taper relatively simple and accurate.

The French Forest Service (Service des Eaux et Forêts) publishes a thin note book which contains two types of standard volume tables. These are both "universal" tables—that is, they are applicable to any species. The first gives simply the volume of cylinders of given diameters and heights; the results obtained from this are, of course, reduced by multiplication by a form factor. The second gives the volumes of given diameters, heights, and tapers. It is in principle quite parallel to some of the Pacific Coast cruisers' tables, though its arrangement is not quite the same. The drawback to these tables is, of course, that they necessitate the essentially accurate estimation of either a stand form factor or an average taper. Either of these estimates is relatively simple in France, since there are less than a dozen important forest tree species, and the range of values for each and the modifying effect of such factors as age, height, and the like, are well understood. Some French foresters state, for example, that if a form factor of .65 is used for poor stands and .70 for good, the results should be within 5 per cent of the truth, regardless of species or region.

Local tables and tables for individual species are frequently encountered, but they may usually be found on examination to be merely selected or modified values from the tables just described. They are based on tree measurements such as ours, but the results are usually compiled to give either an average form factor or an average taper for the species and region in question. The objections to this method as a general practice are many and too obvious for enumeration. But, again, French conditions reduce the errors to practical insignificance, for when uniform stands are cut repeatedly at the same definite age the average form factor (or taper) becomes a figure which can be determined with reasonable reliability.

Growth figures in France seem to be for the most part merely the

result of repeated experiences in harvesting the forest crop. The determination of the sustained annual yield of a selection forest, for example, usually is accomplished by first fixing some rather arbitrary and very conservative figure (perhaps obtained by dividing the total volume above a given diameter limit by the cutting cycle) and then watching the effect of cutting at this rate on the stand. If the growing stock is seen to increase and trees are being left until silviculturally overmature, then the annual cut is increased until the proper conditions are obtained.

The restrictions placed by the French foresters on logging often struck American lumbermen and foresters alike as ridiculously stringent. But while interfering exceedingly with our methods of logging and manufacture they will almost always be found, if sympathetic consideration is given, to be entirely feasible and in accord with French economic conditions (such as cheap labor and high cost of material, etc.). In a similar way, French mensuration, while accomplishing admirably its own particular task, cannot be applied in general to our forests. The lesson we learn, then, is not that of methods that we can directly imitate. French forestry is an art rather than a science—an art with a few simple canons, but which must be practiced with patient personal devotion; it is never a machine that any fool can run. But it heads straight for the desired goal. If formulæ and classifications are seen to hinder and delay rather than to assist, they are immediately discarded. A rule of thumb that *works* is esteemed far above a scientifically accurate but unwieldy formula.

May not this point of view tend to clean out some of the cobwebs that are already gathering in some of the corners of American forestry?

COMMENT ON "A FORMULA METHOD OF ESTIMATING TIMBER"

By Donald Bruce

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Professor Terry in his article in the April issue of the Journal proposes a new method of preparing volume tables and of computing estimates which, if it could be proven sound, would result in a very material saving of time and effort in these two labor-consuming operations. As he requests criticism and suggestion, the following comments are offered:

A fundamental assumption of his work is "that for a given species in a given region . . . the ratio between the cubic and board foot contents (considering only the merchantable stem) of the trees of each diameter class will be practically constant." No evidence is given in support other than the argument that this hypothesis "seems to be reasonable." In the opinion of the writer, analysis will not confirm this statement.

Let us take a diameter class at random, say 32-inch, and see what the ratio actually would be for trees within it which are of the same form but of varying heights. The simplest form to compute is that of a tree of absolutely regular taper to a fixed top, say 8 inch—that is, the frustum of the cone. The merchantable form factor of such a tree will be

$$\frac{\text{volume of frustum of cone}}{\text{volume of cylinder}} = \frac{\frac{\pi}{12}(32^2 + 8^2 + 32 \times 8)\,\text{height}}{\frac{\pi}{4} \times 32^2 \times \text{height}} = .44.$$

This value is constant for the class, since it is independent of height. But if such trees are scaled as 16-foot logs, the following results:

Height in 16-foot logs.	2	3	4	5	6
Scale of tree in 16-foot logs, Scribner Decimal C.	310	590	920	1220	1530
Volume in cubic feet of corresponding cylinder..	178.7	268.1	357.4	446.8	536.2
Ratio, scale to cubic volume	1.73	2.20	2.57	2.73	2.85

It is evident that for a constant form factor this board foot-cubic foot ratio may vary widely within a single diameter class, increasing with height. The variation between two and eight log trees, as above indicated, is nearly 65 per cent, or one-half as much again as the variation given in Terry's table resulting from a change in diameter from 12 to 36 inches. It should be noted, however, that Terry's trees of the 32-inch class only range from about 4 to 6 logs, and that the increase within this narrower range is only about 11 per cent. This is doubtless why the fallacy in his assumption did not come to light in his study. Nevertheless, in any other region where the height range for each diameter class is great, as is the case both on the West Coast and in the Inland Empire, the danger of this seemingly innocent hypothesis is apparent.

If this ratio is not constant within each diameter class the fact that the form factor for the class is constant makes the product of form factor and ratio variable with height, and the method if accepted can be considered only a rough approximation. This can be seen from another consideration, as well. The formula developed finally takes the form $V = bH$ (where $V =$ volume in board feet, $H =$ height in feet, and $b =$ "board-foot form factor," which is constant for each diameter class). But this is the equation of a straight line passing through the intersection of the V and H axes. If the formula is correct, therefore, all the diameter class curves of the graphed volume table would be portions of straight lines which, if produced, would radiate from the origin. I have redrawn the curves of a number of the best volume tables in my possession and find no such tendency apparent. Occasionally the straight line form of curve is approached (this is always true in the case of tables prepared by the frustum-form-factor method), but these straight lines either do not radiate from a common point or, if they do, that point is remote from the origin. The evidence of existing tables, then, seems once more to contradict the fundamental hypothesis of Terry's method.

Of course, if the diameter class curves in any table are very short, a straight line passing through the origin could be substituted for each of them without introducing any very large errors, and this is exactly what the method under discussion does. It appears, however, that the utility of the procedure is limited to regions where the height range for each diameter class is exceedingly small.

THE DEVELOPMENT OF A BRUSH-DISPOSAL POLICY FOR THE YELLOW-PINE FORESTS OF THE SOUTHWEST

By H. H. Chapman

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Brush disposal in the Southwestern District (District 3) has centered about the western yellow-pine type largely. Its importance lies in the fact that next to marking the timber the method of handling brush is the most important factor within the control of the management by which conditions favorable to silviculture, and especially reproduction, can be created or influenced. In a type and region where natural reproduction is unusually difficult to secure and planting is expensive and its final results uncertain, whatever aid can be given by proper brush disposal becomes increasingly important.

Brush disposal may affect management in several ways, and the problem becomes one of weighing the relative advantages of each factor and securing as great a sum total of advantages as possible. These factors may be stated as:

1. Fire protection. The paramount object is to reduce or control the fire risk created by the slash.
2. Protection against insects. The prevention of the breeding of destructive species in the slash.
3. Soil protection against erosion on steep slopes.
4. Favorable influence on reproduction by creating conditions of:

   (*a*) Proper seed bed.
   (*b*) Protection of seedlings against climatic factors.
   (*c*) Protection of seedlings against grazing animals.

5. Reduced cost of brush disposal as a means of increasing stumpage values in appraisals.
6. Simplicity and practicability of administration, insuring the carrying out of the measures agreed upon.

None of these factors can be neglected in a policy if it is to stand the test of actual practice.

The ideal policy is, then, one which will most rapidly and completely reduce the fire risk, the insect risk, give proper soil protection, secure

the most favorable conditions for reproduction, and at the same time require a minimum of expense and be easily carried out.

The initial policy in brush disposal in yellow pine was to pile and burn all brush on the sale area. This was to eliminate the fire risk, and if carried out would aid in controlling insects. It gave no soil protection and no protection of the seedlings after germination, but probably created a better seed bed than other forms of disposal. But as time went on it was found that while the operator was required to *pile* his brush the brush was *not burned* and the piles remained for years. Areas of piled brush still exist, 9 to 10 years old, and these piles will burn today with considerable heat and form a fire menace of some proportion. This failure to burn was not due to lack of good administration, but to the difficulty in this district of finding a proper time in which to safely burn large areas of brush.

There are but three chances for this—the first snows, the spring and the summer rains. It frequently happens that the first snow comes suddenly and sometimes is two feet deep. Such piles as are burned at once in the storm before the snow gets too deep are the only ones that can be burned, and if the officer happens to be on other duty that day he waits till spring. He then finds that the inside of the pile remains so damp that it will not burn, long after the surface litter has dried out so it will carry a fire. Spring burning has therefore had to be largely abandoned. The summer rains on the whole offer the best opportunity to an alert officer. But these rains are variable and light, and unless the brush is burned at once after a rain or during the rain the fire escapes frequently into the unburned slash, runs broadcast and destroys seed trees and reproduction. For these reasons it has been found impractical to burn all brush, and it takes good administration to secure the burning even on fire lines.

Piling was also the most expensive method, requiring the most labor. When it became evident that after requiring the operator to pile, the Service was unable to secure the burning of the piles, the system broke down, and the second era, known as lopping, was ushered in.

Top lopping consisted of lopping off all the limbs on the top and scattering them to lie flat at a safe distance from the live timber. While inferior to piling and burning as a measure of fire protection, it was better than piling *without* burning. It also secured the maximum soil protection against erosion where needed and was simple of enforcement.

Scarcely had this method been substituted for the piling and burning, when Dr. Long developed his theory of rot, and showed that limbs

when left on the bole decayed faster than when cut off and lying flat on the ground. Based on the theory that the early disappearance of the wood of the limbs and tops was of primary importance, this was a strong argument against top lopping. It happened that the large timber sales in yellow pine were located almost exclusively on the north half of the Coconino and the Tusayan National Forests, where there is a conspicuous absence of natural reproduction and excessive damage from sheep grazing. The idea of leaving the tops as they fell without lopping appealed strongly to the timber operators, of course, and to the Service this policy had the advantage of increasing stumpage values by reducing the cost of brush disposal from 50 cents in piling and 35 cents for lopping to 15 cents for top lopping. It was thought, also, that the limbs if left on would keep sheep from eating and cattle from trampling the seedlings and would give grass a chance to produce seed. To secure fire protection of standing timber, the tops must be removed to a suitable distance from live trees. This distance was set at 20 feet and afterward increased to 25 feet and even to 30 feet. In this form "top pulling" was authorized as a substitute for lopping or piling and burning.

Standard instructions, issued in 1916-17, cited all three methods as permissible and left the choice of them to the supervisors. Top pulling became standard practice for the big sales on the Coconino and Tusayan.

But on the New Mexico forests, and generally on small sales, it was found that top pulling worked out very badly as an administrative measure. When small operators were permitted to "pull" tops, they could seldom be induced to get them consistently far enough from live trees for protection. The laborers could not get the idea of what was wanted and the operators tended to leave tops as they fell and call it good enough.

It also developed that on forests or areas of abundant reproduction it was impossible to pull tops far enough in any direction to get them away from the young timber. Finally, it became evident that the fire danger was apparently much greater when the limbs, with their needles, were left on the tops than when these were lopped off. The necessity of getting rid of the *limb wood* by decay had been apparently overemphasized as a matter of fire protection.

If the reduction of the excessive fire risk created by the slash is of first importance, the character of this risk was the point to be considered. The destruction of standing live timber in case of fire was caused either by roasting the cambium of the bole or by destroying the foliage

of the crowns. The *nearness* and *intensity* of the flame and *duration* of heat was what caused damage to the bole, the damage, of course, being in inverse proportion to the thinness of bark. But the damage to crowns was due to the nearness and height of the column of flame rather than to its duration.

Pulled tops—that is, tops left intact—were found to throw columns of flame to considerable heights and distances in a slash fire as long as the needles remained on the branches. The disposition of *the needles,* not the decay of the wood, was evidently the important consideration in preventing injury to crowns of live trees. The needles, as long as they stay on these tops, constitute an extreme hazard, which can only be combatted by moving them far enough from live trunks so that the flames cannot be blown into the tops. When the danger from the needles is gone, the remaining risk from the burning of the wood can be controlled. In fighting a fire burning through pulled or intact tops, it is practically impossible to handle them or construct a temporary fire line through them and larger areas are burned. The fire travels faster and is more dangerous than if the tops are lopped.

When tops are properly lopped, the first winter's snow packs the needles close to the ground and the damage from high flames disappears. The tops being cut are more easily handled for a temporary fire line. In areas with abundant reproduction the lopped tops give better protection to the young trees. The crown, with its inflammable needles, can be trimmed out, the branches laid flat or scattered in openings, and the reproduction freed from this tangle.

But the greatest argument in favor of lopping and scattering lay in the simplifying of administrative procedure. This question came up this summer in concrete form on the Carson National Forest. Here, in an effort to draw up instructions which required the minimum expense consistent with fire protection, the practice was to require piling and burning on small sales in Douglas fir, while in yellow pine lopping was required except where tops lay at a distance of 20 feet from the nearest live trees, when they need not be handled at all. The combination of systems made the instructions cumbersome and inconsistent in application. The small man was required to do more clean-up work than large operators, and neither the lumbermen nor the rangers were ever sure they were doing things right. The instructions had to be essentially modified in application to the Douglas-fir type.

On the Santa Fe Forest it was found that a consistent policy of top lopping was being practiced on large and small sales alike and in all types with great success. The one point needed was to determine just

how far brush should be moved away from standing timber and reproduction to prevent damage to boles and crowns. After thorough discussion, a uniform policy was formulated, applicable to both forests and to both yellow pine and Douglas fir types. This policy definitely substituted top lopping for pulling, which was discontinued.

By making certain changes in the wording for the two types and running the instructions in parallel columns, and by allowing sufficient elasticity to enable the officers in charge of the sales and the supervisors to fit the instructions to conditions on the sales, this policy was extended to include all the New Mexico forests, and has been adopted on all the forests in Arizona, with the exception of the north half of the Coconino and the Tusayan, where the method of pulling does the least harm and is solidly established in practice. The instructions, including general directions for fire-line construction, follow:

STANDARD INSTRUCTIONS FOR BRUSH DISPOSAL ON THE NATIONAL FORESTS OF NEW MEXICO AND ARIZONA, EXCEPT COCONINO AND TUSAYAN FORESTS

Purposes

The purposes of brush disposal are:

1. To put the brush in condition to do as little damage to standing timber as possible in case the brush burns.

2. To secure as rapid a disappearance of the brush as possible by decay.

3. To give protection to the soil, prevent erosion, and secure favorable conditions for reproduction.

4. To construct practical fire lines and to put brush in the best condition for combatting a fire.

Yellow Pine Type

1. The piling and burning of brush, except on fire lines or where required for the control of destructive insects, will be discontinued.

Douglas Fir Type

1. The piling and burning of brush, except on fire lines or where special instructions are issued governing the sale, will be discontinued.

2. All tops shall be lopped, by having the branches cut off from all sides, close to the main stem, the remaining stub to be less than 6 inches in length. The practice of cutting off only a portion of a branch, leaving a stub attached to the stem, will not be accepted.

3. All brush shall be thrown or removed to a distance of 10 feet or more from the nearest living tree of a commercial species. For trees with live crowns extending to within 15 feet of the ground, this distance shall be measured from a point directly below the outer edge of crown. For trees whose live crowns are higher than 15 feet, it shall be measured from the bole, provided that brush need not be moved more than 25 feet to attain this result. Where the close spacing of trees does not permit the brush to be placed at a distance of 10 feet from living trees by moving it 25 feet, it shall be removed as far as possible from the boles

of living trees, and shall, in all cases, be removed at least 10 feet from the crowns of trees over 12 inches in diameter, even when such trees are standing within groups of smaller trees.

Yellow Pine Type

4. All brush shall be scattered so as to lie flat on the ground and not placed in piles or windrows. Where necessary, in the judgment of the officer in charge, limbs shall be cut into two or more pieces to secure this result.

Douglas Fir Type

4. All brush shall be scattered so as to lie flat on the ground, as far as space will permit. Where brush can be removed 10 feet from the nearest live tree, it shall be scattered flat beyond this distance and not piled or placed in windrows. Where the close spacing of the trees does not permit of removing brush to this distance and scattering it flat, it shall be disposed of to secure both as great a distance from living trees as possible and at the same time as flat a scattering as possible.

5. In carrying out the above instructions, the officer in charge is authorized to waive the requirements for removal of brush from living trees which are under six feet in height, provided this requirement appears impractical or its cost is excessive. When so waived, brush may be left within groups of such reproduction. But lopping shall be required as per instructions under 2, and all brush must be placed so as to lie flat and must neither bear down the crowns of the young trees nor be propped up off the ground by these crowns.

6. The term "brush" means all slash and debris resulting from logging operations, including stems and limbs or parts thereof not exceeding four inches in diameter.

Yellow Pine Type

Douglas Fir Type

7. Where windrows of brush result from the clearing out of skidding tracks and roads or unavoidably in brush disposal, this brush shall be disposed of as indicated by the forest officer in charge or by instructions issued for the sale.

The minimum requirements are:

Prevention of erosion by filling skid trails and roads, where needed, on steep slopes.

Retention of roads or skid trails as strips of bare soil for fire lines. This requires the opposite treatment from erosion.

Protection of live trees over six feet high by removal of such windrows from their vicinity.

Where there is space in which to scatter windrows of brush and this space is not needed for fire lines and the windrows endanger live timber, the brush must be scattered.

Where space does not permit scattering and the windrows have been placed as far as possible from live trees over six feet high, they may be left.

In very dense stands, heavily cut, where a large percentage of the brush removed from around live timber must be piled in heaps or windrows, the reduction of this excess brush by burning of the heaviest accumulations at a proper season is a desirable measure and may justify special instructions. (See 1.)

STANDARD INSTRUCTIONS FOR FIRE LINES, NATIONAL FOREST

Width

The standard width of a fire line is 200 feet. Authority for reducing the width of standard fire lines must be obtained from the district forester.

Construction

On fire lines all brush resulting from logging must be piled and burned. Logs, down timber, and dead tops, or other inflammable material whose presence would tend to render the fire line ineffective, shall be burned, though logs and down timber, except tops, may be skidded off the fire line instead.

The removal of ordinary forest litter from fire lines will not be required.

The brush piles on fire lines must be placed at least 25 feet from trees over 10 inches in diameter and as far as possible from smaller trees. The piles should be large and compact, except when small piles are required in order to avoid destruction of tree crowns in burning.

Location and Extent

Fire lines are intended to divide areas of slash into smaller blocks and to furnish lines from which to back-fire. They will not of themselves stop fires.

Wherever natural features or cover types are so located as to give lines from which back-firing is practical, they will be used in place of constructed fire lines, which need not be constructed along their edges.

The plan of fire lines will be laid out to utilize all parks, grassland or meadows, cultivated lands, barren or rocky ridge tops, and areas of aspen. On the other hand, areas of dense reproduction of conifers, with low crowns, are to be classed as a fire risk equal to slash and given the same protection. Fire lines will be planned along edges of slash adjoining timber which is not to be cut immediately.

Based on the above plan, the extent or mileage of fire lines actually to be constructed will be governed by the size and shape of the areas of continuous slash, or its relation to reproduction and uncut timber.

Fire lines, natural or constructed, should occur at not over half-mile intervals, and the area of continuous slash should not be more than 160 acres, or be five-eighths of a mile in any one direction.

By utilizing natural features, it is expected that the mileage of standard fire lines, whose construction is necessary to give this degree of protection, will not exceed four miles per section and may be less.

Fire lines should usually follow all railroad spurs, except when these are located at intervals smaller than required by the standard, and should always be constructed along main traveled wagon roads.

The location of fire lines should avoid low crowned conifers and coniferous reproduction. If this is impossible, it is better to destroy these crowns by burning on the fire line.

Wide fire lines on ridges with sparse growth are preferable to narrower lines in the bottoms of draws with excessive brush disposal.

The following departures from this standard will be permitted:

1. In yellow pine, where slash is not heavy, areas of 320 acres may be accepted as a maximum, provided fire lines occur at half-mile intervals, cutting approximately at right angles to the direction of prevailing dangerous winds.

2. In Douglas fir, areas of 80 acres may be required as a maximum, especially when the stand per acre is heavy, justifying increased cost per acre for fire lines.

Comments on Brush Disposal in the Southwestern District

By G. A. Pearson

The difficulties of burning large areas of piled brush are recognized. I believe, however, that if it were found otherwise desirable to pile and burn, this difficulty could be overcome.

In pulling tops the greatest difficulty is, as pointed out in the standard instructions of District 3, the complexities which render it almost impossible in practice to get the work done properly. Conditions on most areas vary to such an extent that good results cannot be secured unless a forest officer personally directs the work. As a rule, the tops are not pulled far enough away from living trees. The tendency is to mass a great number of tops in the openings, where in case of fire they would destroy all living trees on the leeward side within 50 feet. I have seen numerous instances of this condition on cuttings on the Coconino Forest. Tops left intact, especially if there are several in a group, undoubtedly make a hotter local fire and throw the flames higher than is the case where the brush is scattered more or less evenly over a larger area. If the tops are placed at a safe distance, all well and good; otherwise they are a great menace.

There has been much discussion of the protective influence of brush, both when scattered and when the tops are left intact. When the tops are left intact, there is apt to be such a heavy accumulation of litter

that seedlings will not start within 10 years after the tree is felled. After that the conditions for the growth of seedlings are undoubtedly better than in the open.

The effect of scattered brush varies greatly in different stages. Within the first two or three years after the brush is scattered, it interferes to some extent with seed reaching the ground and shades the seedlings excessively. On the other hand, it protects against frost and excessive evaporation. After the third year, the needles form a dense mat on the ground, and in this stage they are most effective in preventing seed from reaching the mineral soil. After the needles drop, the shade is comparatively light.

The advocates of brush scattering have made much of the beneficial effects resulting from the addition of organic matter to the soil. I have recently come to the conclusion that this benefit has been greatly overestimated. I have observed on cuttings 15 or 20 years old that where branches have fallen there usually remains more or less litter, but the soil underneath shows no addition of organic matter. In our dry atmosphere the litter instead of rotting tends to dry up and blow away. Where there is a heavy accumulation of litter, as in the case of treetops left intact, brush piles, and the ground under standing trees where leaves have accumulated for centuries, an examination of the soil usually shows a black or brownish color, indicating the presence of humus. My conclusion from these observations is that where brush is scattered lightly, so as to avoid excessive shading and excessive interference with seeding, the effect to be expected from the addition of organic matter to the soil is negligible. One or the greatest advantages of scattered brush is that it tends to kill out grass and other competing vegetation. In order to do this, however, it must be dense, so that when it packs down it will form a mat two or three inches in thickness. I believe that the best results from scattered brush can be obtained by placing two or three branches together, so as to form a heavy cover, but leaving frequent small openings between these piles. Seed can germinate in these openings. The seedlings will receive considerable protection from the surrounding brush. They will eventually send their roots into the area covered by the brush, where they will find considerably more moisture than in spots where there is no cover.

I believe that after weighing the advantages and disadvantages of scattered brush the net balance will be favorable. We have tried to secure concrete evidence by observing areas where brush has been scattered, but unfortunately after ten years, although there seems to be a slight advantage in favor of the brush, results are not what I would

call decisive. During the past season I have tried to get at the problem by measuring the direct effect upon soil moisture rather than waiting for the appearance of seedlings. My tests showed that where there was a thin cover of litter, such as would result from laying a single branch upon the ground, the increase in soil moisture was very slight, but where there was a mat three or four inches thick there was a very decided increase in moisture.

In order to secure the advantages of a brush cover without the attendant disadvantages, the brush should be placed around the seedlings after they have started. This seems impracticable under past conditions, but I believe the time is coming when it might be considered practical. Given a seed crop, we can usually depend upon good germination. If the brush is laid around groups of seedlings, there is no doubt that the chances of survival will be greatly increased. Such an experiment was actually carried on at Fort Valley some four or five years ago. The results now show a noticeable advantage in favor of the strips on which brush was scattered.

One factor which may upset our brush-disposal policy is the insect situation. Hopping has come to the conclusion that in California brush affords a breeding place for injurious insects, and he seemed to be strongly inclined to the opinion that the same condition exists here. It seems to me that this is a problem which should be investigated. This, together with our insect problems affecting seedlings, would afford a good field for an entomologist.

REVIEWS

Effect of Grazing upon Aspen Reproduction. By A. W. Sampson. Bulletin 741, U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1919. Pp. 29.

There was a time when the inquiry suggested by the title of this bulletin would have been answered by a wholesale generalized experimental judgment and be left at that. Nowadays, however, when the proverbial man from Missouri is about, wanting "to be shown," nothing short of experimental demonstration and detail statistics, carefully ascertained, will satisfy the inquirers. And, as a rule, by such method more than the original question is answered, as in the present case.

The basis is furnished by some 120 sample plots observed and measured up for five years (a misprint on page 2 makes it 15 years). Clear-cut and lightly thinned areas, different-aged growth, and varied intensity of grazing by sheep and cattle were involved.

We note that apparently no reproduction by seed takes place, but only sprouts from the stump seem to furnish the reproduction.

In Utah, where the study was made, and in some other sections of the Northwest, the aspen, which usually is looked upon as a transitory type, becomes a permanent source of much valuable material; hence the question whether and how to make it serve the double purpose of meat production and wood production. Sheep are doing severe damage to young growth in standing timber, as well as in clear cuttings, to an extent of 27, 32, and 65 per cent, respectively, according to the intensity of grazing, while cattle cause under same conditions only 1.6, 2.4, and 26.8 per cent. As a rule, three years of successive sheep-grazing on clear-cut lands results in the destruction of the entire stand, a notably greater proportion of the woody stems being consumed by sheep than by cattle.

"On lands protected from grazing, aspen sprouts are produced only during the first two seasons after cutting. On grazed lands a considerable number of sprouts are sent up for three successive seasons following the removal of the timber. The third year's reproduction, however, appears from two to five weeks later than that produced in the

two previous seasons and is, for the most part, eliminated shortly after its appearance by adverse climatic factors, chiefly frost.

"A surprisingly large proportion of the reproduction produced, even on the most favorable sites, is killed during the first three years of its growth by causes other than grazing. Frost and bark-eating mammals, notably gophers, field mice, and rabbits, are mainly responsible for such mortality.

"The average maximum height at which sheep browse is approximately 42 inches. Sprouts averaging 45 inches in height are found to be exempt from destructive browsing by sheep, and, since the annual rate of height increment of the aspen reproduction averages about 15 inches, sprouts three years of age are exempt from serious injury by sheep, and those from 4 to 5 years of age are free from serious injury by cattle.

"Aspen is practically unable to reproduce under its own shade, and the best means of obtaining vigorous and dense reproduction, and at the same time of harvesting the timber economically, is to clear-cut the lands or to thin the stand heavily."

A new method is proposed to dispose of the brush in logging, namely, to place the unlopped tops around the stumps so as to protect the sprouts.

"In three or four years, when the reproduction is practically exempt from serious browsing, the brush is for the most part decayed and out of the way. Furthermore, such a disposition of the brush does not make the danger from fire any greater."

The practical deductions from this study for the management of grazing in aspen type to secure best results for the two objects, meat and wood, are to adopt a clear-cutting system and to permit cattle rather moderately, but to exclude sheep entirely for the first three seasons after logging or at least graze only lightly. "But the sheepman who will graze his sheep *very lightly over the choicest of forage,* such as invariably becomes established on clear-cut or heavily thinned aspen lands, has not yet been discovered."

B. E. F.

Effect of Grazing upon Western Yellow-Pine Reproduction in Central Idaho. By W. N. Sparhawk. Bulletin 738, U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1918. Pp. 31.

This study was planned in a similar way to the foregoing, namely, by means of sample plots, some 150, on the central Idaho plateau in three locations of the Payette National Forest. The Forest is mixed Douglas fir and lodgepole pine, with some Abies species forming a prominent part of the admixture, the western yellow pine forming on the average in the three locations 40, 58, and 85 per cent of seedlings, respectively.

"Western yellow-pine and Douglas-fir seeds germinate for the most part during May and the first half of June at the lower and during June and early July at the higher elevations, and occasional seedlings appear all through the summer. Lodgepole-pine germination continues in considerable quantity during most of the season. Western yellow-pine seedlings to a very large extent, and lodgepole pine to a less extent, occur in small, compact bunches, the result of the seeds being buried by chipmunks. . . .

"Sheep injure forest reproduction directly, both by browsing and by trampling. In the case of browsing the injury may be confined to a few needles or to the tips of side branches, the leader may be bitten off, or the bark may be gnawed. With conifers such injuries, except in extreme cases or when repeated, seldom result in permanent deformity or death. . . .

"If the injury is repeated every year or two, of course the seedling will be permanently stunted and will never become a tree. . . .

"Very severe browsing, such as frequently occurs on bed grounds which have been used too much, often kills the seedlings outright. . . . To test the effect of light browsing, only the foliage put out during the current year was removed from a number of other seedlings. This had no apparent lasting effect, since all were fully recovered within a year. . . .

"Of the three important species present, western yellow pine appears to be most liable to browsing injury, lodgepole pine somewhat less so, and Douglas fir least. White fir is practically never browsed. . . .

"Of the 1,782 seedlings killed, 1,294, or 73 per cent, were less than a year old, while only 11, or about one-half of 1 per cent, were over 6 inches in height. Only one seedling over 18 inches high was killed by sheep during the three years. Only one sapling over 3.5 feet high was

browsed or trampled; most of the injuries from browsing or trampling were confined to seedlings less than 1.5 feet in height.

"The relative mortality of seedlings of different sizes is shown in Table 3. During the first few years seedlings succumb very easily to slight injuries, because of their small size, shallow root system, and the lack of woody matter in their stems. The loss due to grazing decreased from about 20 per cent for seedlings in their first year to 11 per cent for those in their second and third years. By the end of the third year they are from 8 to 4 inches high (depending on species and site), their stems have become woody and fairly tough, and their roots penetrate the soil for a foot or more, so that they are not easily uprooted by trampling nor exposed to drying by the loosening of the soil. Injury from grazing is so slight after this that there is no need for closing reproduction areas to sheep after the third year, though it may be desirable to graze such areas lightly for a few years more, until the seedlings reach a height of 6 inches. . . .

"Where the forage is composed largely of tender herbaceous vegetation reproduction is more subject to damage than where there are shrubs or dense tufts of perennial grasses or weeds to protect the seedlings. . . .

"Taking the combined areas as a whole, more than three times as many seedlings were killed by other causes as were killed by sheep-grazing and five times as many were injured."

The author attempts the valuation of damage by a more or less novel method. Correlating height growth and number of killed and injured in each size class, a mortality or number decrease table and curve is constructed, and from this is determined the "average number of seedlings per acre at different ages necessary to insure a stand of 100 trees per acre of any of the three species at 150 years, if ordinary grazing every year is permitted."

The difficulty lies in determining what the normal stand should show, without which the method has little or no value. In actual cited cases the full stand at 150 years varies from 40 to 230 trees.

"If 40 trees per acre are assumed to constitute a full stand, but 0.4 as many seedlings as are indicated in Table 16 will be needed; but if 200 trees per acre are assumed, the figures in the table should be doubled. If a full stand of Douglas fir is taken as 167 trees, the figures should be increased by two-thirds for Douglas-fir stands. Assuming 250 trees per acre as normal for lodgepole pine at maturity (140 years), the figures in Table 16 should be multiplied by 2.5—that is, there should be approximately 3,700 seedlings the first year;" and the author concludes:

"On areas as well stocked with reproduction as those covered by the study the comparatively small amount of scattered injury which results when the stock is carefully managed can hardly be said to represent a tangible loss of value."

Then, without very convincing basis for the valuation, he continues:

"If seed trees are present in sufficient quantity to reseed the area, the loss will equal the value of the growth already made by the seedlings. which at 10 years of age will be approximately 30 cents per acre, or $0.001 per tree if there are less than 300 seedlings per acre, and at 20 years 75 cents per acre, or one-third of a cent per seedling where there are less than 250 per acre. These values, which are based on an average annual increment (for a 150-year rotation) of 100 board feet per acre and a stumpage price of $5 per 1,000 feet, are liberal. With an average annual increment of 200 board feet, which may be possible on the best sites, the loss would be 60 cents and $1.50 per acre at 10 and 20 years. . . .

"Benefits to the forest resulting from the use of the range may often offset the slight damage done by regulated grazing. These benefits may consist in direct aid to forest reproduction or in lessening the danger of serious fires. . . .

"The value of sheep-grazing in helping tree reproduction to start is frequently overestimated. It does result in more abundant germination under certain conditions, viz., in case of heavy grazing on poor sites."

The author then elaborates the proper methods of handling the stock to insure least damage.

B. E. F.

A Note on Thitsi, Melanorrhœa usitata, Wall., with Special Reference to the Oleo-resin Obtained from It. By E. Benskin and A. Rodger. Indian Forest Records, Vol. VI, Pt. III. 1917. Pp. 97-127.

This publication takes up the description of the tree, its common names, distribution (with map), a brief discussion of its reproduction, and the timber it produces. The method of tapping for oleo-resin is described and the costs, yields, and experiments to improve the qualities of the product are discussed.

The tree, discovered by Dr. Wallich in 1828, is found with Dipterocarps and other species that thrive on the drier forest soils of Burma, at an altitude of about 3,500 feet. It occurs plentifully over an area of more than 5,000 square miles and is found scatteringly over nearly

7,000 more. Eight trees to the acre, or a proportion of between 1 in 50 to 1 in 100 of the other species, is considered a favorable stand. The trees are usually straight, with a considerable clear length and a spreading crown. The girth of mature trees varies from 7 to 14 feet and large trees attain a height of from 50 to 60 feet. Foliage is shed in January, at the time of flowering, and new leaves appear about the middle of March. Fruit matures between March and June. The wood is dark red, very hard and durable. It is used for buildings, bridges, and turnery. The tree is valued chiefly for its oleo-resin or varnish.

The tapping of this tree, which is allied to the Japanese lacquer tree, to obtain its oleo-resin, is done by making two notches, 8 to 10 inches long and two inches deep, in the bark in the form of a "V." A bamboo cup to collect the varnish is hung at the base of the "V." The yielding season extends from June to January, the best yield occurring from July to October. Rains cause damage by washing away or diluting the oleo-resin. A very little water will cause a reddish color which degrades the product. Three tree varieties—black, red, and white—are recognized by the Burmese. These yield three grades of product, rated according to their drying capacity: I, pure black (not adulterated); II, mixed black (adulterated with the ash of rice husks and concoctions from the bark of *Albizzia stipulata*, added to improve the color); and, III, red (adulterated and also containing water).

The number of cups placed on a tree depends on the length of the operation and the size of the trees. The notches are placed one above another, as high as a man can reach; sometimes ladders reaching to a height of 30 feet are employed. After a season's tapping, the scars must be left from 4 to 5 years to heal. New scars, however, can be opened elsewhere on the tree, the number depending on its size. The need for careful consideration of the number of blazes and the desirability of experimental data on this subject and on the length of rest periods is pointed out. It is advocated that a limit be placed on the size of trees tapped, a minimum girth of four feet six inches being recommended.

The oleo-resin is said to exude from the inner bark near its contact with the wood, but no discussion of the structures involved is given. The bark at the base of the "V" is slightly lifted from the wood when the blaze is made. Subsequent cuttings, to freshen the surfaces, make the included angle less acute. According to earlier writers, the first cut is left for ten days and then freshened and the cup moved up. After another ten days, it is said, the scar is abandoned. The varnish exudes as a thick grayish fluid, which turns brown and then jet black on ex-

posure to the air. Some workers are susceptible to poisoning, resulting in inflammatory swellings, from a volatile oil which the varnish contains. An antidote is said to be an infusion of teakwood. The addition of ferric oxide also stops this action and increases the drying capacity of the varnish. Stirring in shallow, open vessels also liberates the oil.

The yield varies widely; a crooked tree with scant foliage often yields well, while large trees may yield little. An estimated annual yield for a tree with 5-foot girth is given as about 15 to 20 pounds. On page 103 the statement (from Brandis) is made that one man collected from 146 to 182 pounds (40-50 viss) per season—that is, he made and cared for 1,200 scars, 200 per day. Again, on page 117, it is stated by the writers that a good workman should be able to gather 360 pounds (100 viss) a year while superintending 500 notches, or about 200 trees. The monopoly for the collection of gum on Government areas is sold annually. The total yield from the Government forests is about 200 tons per annum. The approximate cost, before the war, of landing one ton of the varnish in England was about £64.

The chief use of the oleo-resin is for Burmese lacquer-work, an industry in which some 7,000 people are engaged. This is discussed at some length. The oleo-resin is also used as an indoor and outdoor varnish. Wood treated with this coating, presumably because of its hard surface, is thought to be resistant to termites, fungi, and teredo. (Experiments to verify this are under way.) It is further used for calking boats and gives a desirable surface for objects to be coated with gold leaf. This varnish is little known in Europe and attempts to introduce it have met with little success; for, though free from certain acrid and irritant properties of the Japanese varnish and resistant to strong alkalies and acids, the length of time and the manner of drying required are causes of complaint. Slow drying in a relatively cool, dark, damp place is needed. Studies on the chemical nature of the oleo-resin (*Indian Forest Record,* Vol. I, Pt. IV, 1909) are cited and the results and recommendations from some more recent work by the authors given. This includes recommendations to avoid iron tools and vessels, dust and sesamum oil (substitute linseed). The stirring practiced by the Japanese, to make the varnish homogeneous and free from the volatile poisonous oil, is advocated; also the tapping of the lower parts of the tree. Ferric oxide was used successfully as an agent to improve the drying capacity of the varnish, but it somewhat dulls the finished surface. Turpentine or *Boswellia serrata* oil may be used successfully for thinning, but they do not increase the drying properties.

They tend to give a reddish color, an effect which may be counteracted by the use of ferric oxide. The authors think that this natural varnish should compare favorably with the lacquer varnish now exported from China and largely used in Europe. E. G.

The Use of Wood for Fuel. Bulletin 753, U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1918. Pp. 40.

The title-page of this bulletin professes to be a compilation, and as such it deserves considerable credit. As a historical document it will serve to record the effort made by foresters throughout the country to promote an increased use of fuelwood in order to conserve coal. For the most part this was an emergency movement, and its real object may be said to have ended with the signing of the armistice. So with the bulletin, which was evidently conceived as a part of the propaganda and was ready for distribution after the fuel crisis was past. The date of publication is March 10, 1919—four months after the signing of the armistice. This, however, is a point scarcely open to criticism.

The chief value of this publication, and the principal excuse for its continued distribution, is that it contains within a single set of covers practically everything of value that has hitherto been published regarding fuelwood, its production and use, together with some of the methods employed to encourage a more wide-spread acceptance of wood as a substitute for coal.

When one considers the amount of attention which was given to this subject during the period when we were in the war, it is disappointing that a Government publication should contain such a paucity of original scientific material. This is not a reflection upon the person who compiled the bulletin, but rather upon the profession, to which the nation looks for such information. Apparently little thought has been given to the subject of fuel values of the various woods since Sharples' work for the Tenth Census. The weights of woods have been revised by the Forest Products Laboratory at Madison, but the heat values of the various species of wood are still theoretical. Over six pages are devoted to tables of fuel values based upon the assumption that each pound of dry wood contains 7,350 B. T. U. which are available when the fuel gases are 300° F.

Wood is such a complex material and there are so many varying factors for each separate species that this table can at best serve merely as an index of comparative wood-fuel values. This criticism is further

substantiated by the note on page 30, at the close of Table 8, to the effect that the theoretical number of available heat units in a cord of air-dry longleaf pine is 22,000,000 B. T. U. In case this air-dry longleaf pine contains 20 per cent resin, it will have a value of approximately 26,400,000 B. T. U.

After studying these figures one comes to the conclusion that if further attention is to be given to the use of wood for fuel, more definite figures on the actual heating values of different kinds of wood must be secured. The only practical method of determining the true heat value of any fuel is to burn it in a bomb calorimeter or some similar device for directly measuring its heat value. As yet, very few, if any, such figures seem to be available. It is quite apparent that the compiler did not have access to any.

Some interesting data for the purpose of assisting to prepare cost figures on the preparation and transportation of cordwood are given. On page 20 a plea is made for the selling of fuelwood by weight instead of by volume. This suggestion deserves careful consideration, for the advantages to both the producer and consumer are many. Practically all the available information on the use of wood fuel is here presented, as well as a summary of the various methods employed for promoting the use of wood for fuel. On the whole, the Forest Service is to be commended for preparing a bulletin wherein may be preserved the bulk of information regarding wood fuel, which appeared as a result of our participation in the world war and the accompanying fuel shortage.

Recent figures compiled by the Federal Bureau of Crop Estimates make one wonder to what extent wood really did help out in conserving coal. In spite of the special State bulletins and the wood-cutting bees, descriptions of which filled the papers; in spite of the experience of many patriotic individuals who tried to save coal by burning wood, there is recorded no remarkable increase in either the production or consumption of wood during 1918. The figures recently given publicity show that a total of 102,903,000 cords of fuelwood were produced in 1918, of which 77,092,000 cords were used on the farms. The writer has been unable to get definite figures showing the production of cordwood for 1917, but the amount consumed on farms is given as 82,777,000. It was estimated before the war that our annual production of cordwood was about 100,000,000 cords. This is in line with the figures given for 1918, which in turn show a considerable reduction in the use of cordwood on farms for 1918. The average cord value at the farm or near-by town increased from $3.42 in 1917 to

$4.73 in 1918. In several of the Northern States the average price was practically twice this. Some slight discrepancy may have been caused by different methods of securing figures and a more general conception of a cord as meaning 128 cubic feet, rather than a "short cord." When one considers the decreased labor supply, with its resultant high cost, it is not at all unlikely that, except for the wood-fuel campaign there would have been an actual decrease in the production of cordwood. Certain it is that the propaganda helped toward the purchase of fuelwood, in spite of higher prices than ever before in the history of this country. Had the war continued through the winter of 1918-19, there would undoubtedly have been a much greater consumption of fuelwood, which would have been noted not so much on the farms as in the villages and smaller cities, in which case this bulletin would have been of value in correlating the wood-fuel campaigns which were carried on throughout the several States.

A Study of the Frustum Form Factors of Hard Maple and Yellow Birch. By B. A. Chandler. Bulletin 210, University of Vermont and State Agricultural College, Burlington, Vt., March, 1918. Pp. 38, plates 8.

A form factor is the ratio, expressed decimally, between the volume of a tree and the volume of a geometric solid of equal height and basal area. There are several kinds of form factors, depending on how much of the tree is included in making the volume calculations and at what point the diameter of the tree is measured. In this country it is generally understood that the diameter of the tree is measured at breast-height, and that the volume of the stem, exclusive of the branches, is used in comparison with the volume of a cylinder. This is called the "breast-height stem form factor," or simply "the form factor." If, however, the volume is understood to include not only stem, but branches, it is called the tree form factor; if only the merchantable portion of the stem is included, then it is called the merchantable form factor. In recent years other kinds of form factors have been devised, as, for example, the so-called frustum form factor, comparing the board-foot contents of trees, within certain merchantable limits, with the board-foot contents of ideal frustums of cones, in which the taper is regular.

If the time ever comes when the cubic foot becomes a common unit of measure in this country, it is quite probable that form factors will be more generally used here. For the present, the use of form factors will doubtless be confined rather closely to theoretical investigations.

It is along these lines that Chandler's study is of particular value, bringing together under a single cover the results of all previous investigations on the subject of form factors and by his contributions extending our knowledge very materially.

After demolishing, by an iconoclasm based on relentless logic, our trust in all methods of estimating hitherto developed, the author states:

"If, then, an adequate volume table based on diameter and height is to be attained, it will be necessary to develop an expensive and complicated system. The data must be kept in the taper curve form and be rescaled whenever a new log rule is used or market conditions change. At least two sets of taper curves must be available for each species, for each quality site—one for old growth and one for second growth. Probably more than two would be needed later, divided on the basis of age. Such a system would be costly, complicated, and impossible."

He then goes on to cite actual examples of stands within the same forest type wherein the divergencies of form are so great as to make it practically impossible to construct a height curve which will be a true average, or to determine the average taper.

"In such stands," says the author, "it becomes necessary to abandon the type as a unit of area for estimation. The trees of each form must be tallied separately and to each form must be accorded its own height curve and volume table or form factor. The use of one volume table with separate height curves alone will not answer here any more than for different sites, for all bole forms and tapers are averaged together. This results in an overestimate of the more poorly formed trees with heavy taper and an underestimate of the full-boled trees."

The author proceeds to discuss the factors which control volume. Diameter and height have been considered the only volume factors with which it was necessary to deal in the construction of volume tables. The author believes that there are two other factors which must be taken into consideration—taper and bole form.

"In order to obtain a clear idea of the real meaning of taper the merchantable length of a tree above diameter breast high must be considered as the frustum of a perfect cone. Taper then becomes the rate of decrease in diameter in this frustum. The degree of departure from the perfect cone frustum is the other new factor to be considered, namely, that of bole form.

"Of the four factors directly influencing merchantable volume, namely, diameter (diameter breast high), height, taper, and bole form, the latter is the only one which is unnecessary for computing the vol-

ume of the corresponding cone frustum. In so far, then, as the first three factors are concerned, the exact volume of a tree showing any possible combination of these factors can be computed by mathematical calculations.

"It is the opinion of the writer that, as a matter of fact, taper ratio (ratio top diameter and diameter breast high) is a better expression of taper than is its amount per unit of height or per log, although it introduces an entirely new conception.

"The relationship between the form quotient, taper ratio, and the frustum form factor was discovered by expressing the frustum form factor in terms of the volume formulas of the geometrical figures which resemble trees. It is evident that when the frustum form factor is greater than unity the form of the tree approaches that of the paraboloid, and that when it is less than unity it approaches that of the neoloid."

After discussing the opportunities for and need of further studies, the author admits that his formula for finding the value of the absolute diameter breast high frustum form factor in terms of the taper ratio and form quotient is too involved to come into general use. He believes, however, that "the intelligence with which the frustum form factor is used is conditioned upon the fullness with which the laws governing its variations are understood. Eventually these laws will be reduced to some simple form that may be used generally by timber estimators, while for the present in most practical work contentment with more or less approximate values will be necessary."

In its application to practical estimating, the author makes the following suggestions:

"On any particular area, first find the frustum form factor or absolute diameter breast high cylinder form factor. This must be done first, because if the ratio of top diameter to diameter breast high (taper ratio) and form factor are uniform over a given type, the estimate can be based on the type as a unit of area; on the other hand, if it is determined that there are several different taper ratios and form classes in the same type, it will be necessary to base the estimate on form classes rather than type area and tally the trees by these form classes.

"The necessary measurements are:

"(*a*) Diameter outside bark (d. o. b.) at merchantable height.

"(*b*) Diameter outside bark at one-half distance between diameter breast high and merchantable height.

"(*c*) Diameter breast high.

"(*d*) Height. It is unnecessary to take height in order to obtain f. f., but it can be done most easily at this time.

"From these measurements r (the taper ratio) and q_2 (form quotient) can be computed.

$$r = \frac{d}{\text{d. b. h.}} \qquad q_2 = \frac{d_2 - d}{\text{d. b. h.} - d}$$

"In which d = top diameter.
d_2 = diameter half way between diameter breast high and top."

The steps in computing the estimate are as follows:

"(*a*) Draw a separate height curve for each type or form class on the basis of diameter in the usual way.

"(*b*) Pick out of the general table of cylinder volume the volumes corresponding to the heights shown by the height curve. (See appendix for tables.)

"(*c*) Apply the cylinder form factor computed in the field to these volumes. This will give the volume in cubic feet. It may be converted into cords in the usual way or into board feet by use of the mill factor determined in the field."

The reviewer coincides with the author's own conclusion that this system of timber estimating will appear to many readers to be needlessly complicated. But, as he says, "former systems have sacrificed accuracy to simplicity. The proposed plan, like a green colt, needs to be used, and in proportion to its use will be better understood and found the more serviceable."

The scholarly character of the text is marred by certain unfortunate lapses and typographical errors. Thus "quality site" in place of "site class;" "Woodman's Handbook;" the sentence, on page 16, beginning: "Therefore, if the laws by which the frustum form, it will . . . ;" "Forest" instead of "Forestry Quarterly," and the cryptic reference No. 9 in the bibliography to a publication by the Austrian Experiment Station on the form and contents of larch.

It is also to be regretted that the basic tables for yellow birch and hard maple, specifically referred to on page 28 of the text, do *not* appear in the appendix. The quaint editorial explanation that "they are voluminous almost beyond words to describe" scarcely satisfies.

The profession owes much to such painstaking investigators as Chandler. It is only by delving in fundamentals that real progress is made. This study is indeed "founded on a rock," and some idea of the amount of excavation it required is gained by a careful perusal of the bulletin.

A. B. R.

Creosote Treatment of Jack-pine and Eastern Hemlock for Cross-ties. Bulletin 67, Dominion Forestry Branch. Department of the Interior. Ottawa, Canada. 1919. Pp. 24.

The main value of this investigation lies in the development of a new process of impregnation. The principal native timbers used for tie purposes in eastern Canada at the present time are, in order of importance: Jack-pine (*Pinus banksiana*), eastern cedar (*Thuja occidentalis*), eastern hemlock (*Tsuga canadensis*), tamarack (*Larix laricina*), and the several species of eastern spruce (*Picea* sp.). In addition, smaller amounts of hardwoods are used, the most important being birch, maple, and beech.

The life of untreated jack-pine and hemlock ties in the main track is estimated at 7 and 6 years respectively. While no difficulties were found in impregnating jack-pine, and with a two-hour pressure period and an absorption of 13.6 pounds of creosote per cubic foot in the average, a fairly satisfactory, although somewhat erratic, penetration, averaging 5/8 inch, was secured, hemlock proved refractory, and even in a six-hour pressure period the penetration was quite unsatisfactory, slightly over 1/4 inch, with 23.2 pounds absorption.

Then, following up a suggestion coming from Austria (see *Forestry Quarterly*, Vol. X, 749), the process of making small holes in the surface of the timber to facilitate penetration and distribution of preservative was developed. Various methods of making the incisions were invented; finally, an incising machine with knifelike projections (like the rounded tip of a table knife) was found the most satisfactory. "The incisions used were relatively long and very narrow and were so made that the disturbance to the fibers of the wood was very slight, and so that the incisions closed up after treatment and were barely noticeable. The arrangement or spacing of the incisions was found to be of great importance. Suitable arrangement permits of uniform distribution of the preservative throughout the treated zone in a relatively short period.

"These incisions, as distinct from round or other holes or perforations, present to the direct action of the preservative a much larger surface for penetration across than with the grain, thus somewhat compensating for the fact that wood is much more easily penetrable with than across the grain, and enabling a much more uniform distribution of preservative to be obtained than can usually be secured in ordinary practice. It was also found that by incising timber in this way every unit in a charge showed satisfactory penetration.

"Tests made to determine the effect of incising on strength indicated that with the type and arrangement of projections used the reduction in strength was so slight as to be negligible."

With a two-hour pressure period a very uniform penetration of heartwood hemlock, estimated to average ¾ inch with 18.9 pounds to the cubic foot, was secured, and in jack-pine, with one-half hour and 11.2 pounds, the penetration (⅞ inch) was excellent.

Trials of this incision method on a commercial scale seem desirable, provided the mechanical wear on the rather soft ties will warrant the expenditure in lengthening the life of the tie from the point of view of rot, or can by tie-plates be compensated.

B. E. F.

Forestry as Applied in Hawaii. By C. S. Judd. (Reprint from the Hawaiian Forester and Agriculturist, Vol. 15, pp. 117-133, May, 1918.)

This paper, originally delivered as an address, is divided into two parts—the first a popular discussion of forestry in general, and the second covering Hawaiian problems. Once heavily forested except on the lee slopes, these islands now have only 20 per cent of their area forested. There are four general types of forest—the Algaroba type (*Prosopis juliflora*), the lowest, followed by the Kukui type (*Alcurites mollucana*), Ohia lehua type (*Metrosideros collina polymorpha*), and the Mamani type (*Sophora chrysophylla*). The Ohia lehua type is protection forest, pure and simple, and the types adjoining above and below have a large protective value, although they may be worked for their timber in a minor way. The Algaroba type alone is primarily commercial. Protection is a prime requisite, because the irrigated sugar industry in the lowlands depends upon these rain forests. Cutting, but more particularly grazing, has caused the deterioration of the forests and their replacement by hilo grass. Methods of ridding the forests of this grass are discussed, and warning is sounded against wholesale importation of exotics which may prove worthless pests in Hawaii.

F. S. B.

What the National Forests Mean to the Water User. By S. T. Dana. U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1919. Pp. 52.

This is a "stylish" publication, in artistic dress, on glazed paper, highly finished pictures comprising more than half the contents. The

contents are of a propagandist nature and of popular character, making irrigation projects, water-power development, and domestic water supply appear dependent on forest conditions. The few isolated examples of torrential action cited suggest the propriety for the Forest Service of enlarging in this field of inquiry and collecting with discretion all the cases which can be truly authenticated of changed water conditions due to deforestation and reforestation.

B. E. F.

A Further Note on the Antiseptic Treatment of Timber. By R. S. Pearson. The Indian Forest Records, Vol. VI, Pt. IV, Pp. 128.

The book gives in great detail the results of treatments of several species of Indian timber by brush and tank treatments with a variety of preservatives. Most of the preservatives were patented preparations or materials sold under patented names, but coal-tar creosote, zinc chloride, and sodium fluoride were also used. Although the experiments are not complete, practically all the treatments have materially increased the life of the wood. Creosote oils are giving better service than soluble salts.

Pressure-creosoted ties are being used to some extent in India, although they have to be imported. The author points out that there is a shortage of naturally durable timber in India which is cheap enough for ties, and that considerable quantities of ties are being imported from Australia and the United States. These conditions could be very largely corrected by the use, after preservative treatment, of some of the less durable Indian woods.

While the book is in much greater detail than will appeal to the average reader and is not summarized as well as could be desired, it gives an idea of the status of the use of treated wood in India.

G. M. H.

Meddelanden från Statens Skogsförsöksanstalt. Häfte 13-14, Bde. I and II. Stockholm, Sweden. 1916-17. Pp. 1,300.

"Overwhelming" is the first thought which comes to the reviewer who contemplates the task of wading through the two volumes which record the work of the Swedish Forest Experiment Station for the years 1916-17, comprising not less than 1,300 pages. "Magnificent" is the first impression on opening the book, for it is made up in first-class style, on paper such as we are not accustomed to, as a rule, in our

public documents, and replete with good illustrations. "Exhaustive" is the second impression, when we count the pages devoted to the discussion of some of the subjects, as, for example, when over 300 pages are given to the study of the larch in Sweden, 56 pages to snow damage, and 250 pages to the formation of nitrates in soil.

Fortunately, the Swedes realize that their own language is not spoken or read much outside their own country, and in true international spirit they furnish abstracts of the contents in other languages. This was hitherto done only in German, probably because the work would be most appreciated in Germany; but now some abstracts are in English and others in French; others still in German, without a visible reason for the choice of the language in each particular case.

The material furnished in this work, due to floral and climatic differences, has, to be sure, mostly only indirect value to us, more in Canada than in the United States, and we must limit ourselves to enumeration of its more important contents.

After a full account of the organization and working plans of the station, the following subjects are discussed: the North Swedish pine, 110 pages; snow damage in south and middle Sweden, 56 pages; yield of seed in Sweden in 1916, 20 pages; forest soil analysis, 25 pages; form classes in pine, 36 pages; nitrate formation in soils, 250 pages; larch in Sweden, 300 pages; effect of regeneration measures on formation of saltpeter, 155 pages; studies on the conditions of regeneration in Norrland pineries, 66 pages; influence of lime on humus soils, 14 pages.

The paging is somewhat uncertain, as some of the tables are added without paging or with Roman paging.

We congratulate the Swedish foresters in accomplishing so much with the small appropriations at their disposal.

B. E. F.

Rabbit Growing to Supplement the Meat Supply. By Ned Dearborn. Separate from Yearbook of the Department of Agriculture, 1918. No. 784. Washington, D. C. 1919. Pp. 10.

To meet the insufficiency and high prices of meat, partly due to restricted range, the author advocates the systematic breeding of rabbits, and describes the three principal "utility" rabbits—Giants, Belgian hares, which are really rabbits, and New Zealand red rabbits. Reference is made to European experience, where millions of rabbits are bred for meat—100 million in France alone—and where through Lon-

don four and a half million dollars' worth were imported in 1910. Examples are given of results in breeding in this country, at a cost of 8 to 10 cents a pound, Giants weighing 11 to 20 pounds. The initial stock of 119 rabbits multiplied to 1,200 in ten months.

B. E. F.

Report of the Division of Forestry for the Biennial Period ended December 31, 1918. Territory of Hawaii, Board of Agriculture and Forestry. Pp. 53.

This report covers the activities of the Hawaiian Division of Forestry in 1917-18 and presents chiefly the progress made in placing the forest reserve system under administration and the work of reforestation. On December 31, 1918, there were 47 forest reserves in the islands, with an area of 814,926 acres, of which 68 per cent is Government land. The protection of these areas is vital, as they directly govern the water supplies of lower lands, and fencing against stock and elimination of wild stock from fenced areas is one of the first necessities, as the forests deteriorate into grassy lands if not protected. Fires have been guarded against and only five occurred in the biennium.

Forest extension has been pushed, both the introduction of new species experimentally and the larger-scale planting of species of known worth, largely koa. Jeffrey pine, Coulter pine, jack-pine, Scotch pine, Norway spruce, incense cedar, and white pine have developed well at an elevation of 6,700 feet. A total of 1,632,598 trees of all species have been planted by private land-owners and 776,045 by the Territory of Hawaii in 1917-18.

F. S. B.

Range Preservation and Its Relation to Erosion Control on Western Grazing Lands. By Arthur W. Sampson and Leon H. Weyl. U. S. Department of Agriculture, Bull. 675. Contribution from the Forest Service. 1918. Pp. 35.

A study of the relationship between range preservation and erosion was made on the Manti Forest in Utah by comparing the run-off and the erosion from two areas. The two most important factors were found to be the melting of snow and the summer rains. The run-off from melting snow causes severe erosion when the cover is sparse and the slopes steep, and run-off and erosion varies in intensity with the climatic factors, temperature being most important. Most rapid snow melting and most severe erosion occur where there is a lack of vegeta-

tion. With rainfall, the extent of erosion and run-off depends on the rate at which rain falls, the steepness of slope, the presence of established gullies, the character of the soil, and the density and character of the vegetation.

Studies of plant growth brought out that erosion is detrimental to plant growth because of lack of adequate soil moisture and lack of plant nutrients due to the reduction of soluble plant foods. On eroded soil a new series of succession takes place, and to re-establish the more desirable and permanent species that occupied the soil before depletion requires years of time and good range management. The amount of organic matter affects greatly the water-holding capacity and is shown in the little erosion from fully vegetated lands except during intense rainfall or prolonged heavy rain, and then erosion is not serious. Denuded or sparsely vegetated slopes may, after small storms, have both run-off and erosion. General observations show moderate sheep-grazing on sparsely vegetated range increases the run-off and erosion when the physical factors are favorable to erosion and where erosion is already in the incipient stage. The seriousness of erosion is largely determined by the extent to which ground cover is maintained, and this cover may be destroyed and serious damage result from overgrazing or mismanagement of stock. Deferred and rotation grazing should be practiced and the stock kept under control at all times, with slight changes as erosion becomes manifest. With erosion once under way, mechanical methods are necessary to assist nature.

E. N. M.

Limiting Factors in Relation to Specific Ranges of Tolerance of Forest Trees. By A. H. Hutchinson. Botanical Gazette, vol. 66, pp. 465-493. 7 figures. December, 1918.

The range of forest trees in Canada is correlated with available information on soil and climate. No quantitative data are given. Temperature, moisture, and soil are regarded as the factors most commonly limiting the distribution of trees; but it is shown in a number of specific cases that other factors, such as light, competition, and the time element, may be of great importance. Thus, the southern range of *Abies balsamea* is sometimes determined by competition with *Acer* and *Tsuga*. *Larix americana* is often forced by competing species into habitats which they are unable to occupy. This is generally true of species having a wide range. That the northern range of trees is not always determined by temperature is shown by the fact that the lines marking

the northern range of a number of species are intersected by isotherms. Some 13 species are discussed in more or less detail.

G. A. P.

Disease in Forest Trees Caused by Larger Fungi. By Edwin Cheel and J. B. Cleland. Bulletin 12, Forestry Commission, New South Wales. Sydney, N. S. W. 1918. Pp. 11. Pls. XX.

The paper opens with a brief discussion of the effect of fungi on forest resources—living trees, logs, and manufactured products. It urges forest sanitation.

Short descriptions of the following species are given: *Armillaria mellea* Vahl., *Pholiota adiposa* Fries., *Polyporus squamosus* Fries., *P. portentosus* Berk., *P. eucalyptorum* Fries., *P. fumosus* Pers., *P. ochroleucus* Berk., *P. gilvus* Schwein., *P. dryadeus, Polystictus cinnabarinus* Jacq., *P. sanguineus* (L.) Meyer., *P. versicolor* Fr., *P. hirsutus* Fr., *Fomes hemitephrus* Berk., *F. robustus* Karst., *F. robinsoniæ* Murrill., *F. rimosus* Berk., *F. conchatus* Pers., *F. applanatus* Pers., *Hexagona gunnii* Berk., *H. tenius* Hook., *Trametes lactinea* Berk., *T. feei* Fries., and *T. lilacino-gilva* Berk.

Two of the numerous plates illustrating this paper are drawings printed in color; the others are photographs of fruiting bodies and infected wood.

E. G.

The Ailanthus-tree for Wood Pulp. By W. H. Taylor. New Zealand Journal of Agriculture, vol. 18, p. 223. April, 1919.

Comment is made on an article by V. Fedele on the suitability of ailanthus (*A. glandulosa*) for wood pulp, in a recent issue of the "Monthly Bulletin of Agricultural Intelligence and Plant Diseases," published at Rome. This tree, commonly known as the "tree of heaven," has many qualities which fit it for pulp production. It is readily propagated by root cuttings and transplants well at any age. The growth is rapid, and it has the remarkable habit of making its strongest growth after pollarding. It is said that an acre of trees will yield approximately 25 tons of wood every third year. It thrives very well on every site in New Zealand, even on arid or purely rocky soils. The wood yields 44 per cent of easily bleached cellulose from which paper pulp can be made. Altogether it is considered a tree of great promise for the paper industry.

E. R. H.

PERIODICAL LITERATURE

BOTANY AND ZOOLOGY

Dispersal of Tree Pollen

Hesselman, of the Swedish Experiment Station, reports an interesting inquiry into the extent to which pollen of trees may be dispersed by winds ("sulphur rain"). The observations were made on board two fire-ships stationed some distance from shore, 20 and 37 miles. At these distances the pollen rain was still quite extensive and the number of pollen sacks collected on small saucers was almost precisely in proportion to the distance. Pollen of algæ are carried even to 200 miles.

Since the characteristics of progeny are as dependent on the paternal as on the maternal elements, the author points out the importance of this wide pollen dispersal on the problem of seed supply.

The influence of the far-reaching transport of pollen on fossil floras is also discussed.

Iakttagelser över Skogsträdspollens Spridningsförmäga. Meddelanden från Statens Skogsförsöksanstalt, Häft 16, Nr. 2-3, 1919, pp. 27-60.

Anatomy of Grafting of Spruce on Pine

In tree-cutting in the crown forest Gullberg, in the province Östergötland, of south Sweden, there was cut down a 56-year-old pine that bore a fresh, living branch of spruce of 51 years at 5 feet from the ground. A nearer investigation showed that the spruce branch was really grafted on the pine in a natural way and has lived so without communication with the mother spruce at least 14 years.

A real and effective coalescence being thus physiologically proved, the foreign tissues anatomically, too, are very intimately united. The limit between the different tissues is sometimes undistinguishable, in other cases marked by irregularities. There follows a detailed description of the anatomy.

Anatomiska Egendomligheter vid en Naturympning av Gran på Tall. Meddelanden från Statens Skogsförsöksanstalt, Häft 16, Nr. 2-3, 1919, pp. 61-66.

SILVICULTURE, PROTECTION, AND EXTENSION

British Afforestation Proposals

The report of the Forestry Subcommittee of the British Reconstruction Committee is for the most part unfavorably reviewed in a longer discussion by Elwes and in a brief contribution by Maw.

The latter, who is on record with pessimistic views regarding the financial aspects of forestry and forest planting, accentuates the risk in any scheme proposed, but he hedges by declaring that "if the facts are faced fearlessly, afforestation will benefit in the long run."

Taking the five conifers with which it is proposed to plant up 1¾ million acres, namely, Douglas fir, larch, Sitka spruce, Norway spruce, and Scotch pine, the latter as representing probably the average, according to the committee, in the 80th year, figuring with 4 per cent, the thinnings will have accumulated to around $400 and the final crop amounts to $440. This represents an annual rent of $1.53. Now, the annual outgo is figured at $1.50, leaving the 3 cents as yearly revenue to pay soil rent and planting cost, with interest, which is figured at an annuity of 67 cents, when the land costs $40 per acre planted, and the cost per cubic foot comes to 65 cents. The final total "accumulated loss of capital at the 80th year will be $1,170 per acre"!

As the government will neither want to spend money on purchase of land nor pay rent before revenue comes in, the author suggests "as an inducement to land-owners to forego an *annual* payment of rent to accumulate at 4 per cent compound interest for so long as the land-owner wishes, and that any rent so accumulating should be free of all income tax and also of death duties. Such an arrangement would operate as an endowment assurance policy and would, I think, be very popular with land-owners."

According to Elwes, the committee states the average cost of land at $15, the cost of planting $22.50, the administration $1, and roads construction and maintenance at 50 cents. Land at such price would be "the most barren sandy heaths of some parts of the southern counties or such high-lying and windswept wastes," etc., "the cheapest land, usually the least profitable to plant." The cost of planting is by the author placed at $40 to $50.

The report proposes two methods of assisting private and municipal afforestation, namely, proceeds-sharing, or copartnership, in which "the State would provide the cost of planting and general supervision and would lay down the working plan; the land-owner would provide the

land and the cost of local management. Accounts would be kept of the annual contributions made by each party, and on the basis of these, reckoned up at compound interest, the annual receipts would be divided."

The other method is assistance by grants, in which grants up to £2 and £4 per acre would be made on planting conifers and hardwoods respectively. An alternative suggestion is a loan equal to the amount granted or relief from public burdens to the same amount. The latter course is not much favored by the committee, who state "as it is the less valuable, and consequently lowest burdened, lands which we hope to bring under timber, we are inclined to think that land-owners would make a bad bargain if they elected to have their rates and Schedule A income tax recouped, even for a period of two years, rather than get an initial grant of £2 an acre."

The advantages and disadvantages of both methods are analyzed and no satisfaction found.

Nothing will be done until parliamentary legislation is enacted.

Quarterly Journal of Forestry, April, 1919, pp. 97-100, 101-124.

Pasture and Forest in Switzerland

The need of increased forest production led one of the local foresters' societies (Canton Vaud) to provoke a discussion on the possibilities of increased utilization. From statistics, it appears that in the Jura Mountains over 10,000 acres decrease in pastures has taken place in a period of 20 years, or 20 per cent of the land surface, partly due to the legislation of 1893, establishing protective forests. The forest has gained by so much, partly by being allowed to encroach, which it does readily, and in smaller part by planting.

The question as to whether it is desirable to keep forest and pasture strictly separate or else to combine the two is discussed at length by various authorities, quoted or present. The weight of opinion is on the side of separation, both from the point of view of the pasture and of the forests. The pasture loves full sunlight; shade is damaging it by etiolation, and in consequence reduced assimilation, while full sunlight produces a short, but rich, savory, and nutritious pasture.

All agree on the need of proper location of pasture and forest, so as to secure the protective function of the latter, especially from drying winds; for the rest it should occupy the steeper slopes and rocky sites.

Only one contributor holds to the old order of pasture woods for the high Jura at elevations of 1,000 to 1,600 meters, where the rough cli-

mate, extreme dryness of air and soil, and of violent dry northeast winds requires protection of the pasture by isolated trees or groups. Here, he claims, the presence of trees not only gives needed shelter, but favors the propagation of valuable forage plants and augments relative humidity and precipitation.

Journal Forestier Suisse, May-June, 1919, pp. 65-81.

Reproduction of Quebracho Forests

During the war the quebracho forests of northern Argentina were drawn upon very heavily for fuelwood, both for domestic and for industrial use. Several million tons were cut, and the demand has not yet ceased. There is some anxiety lest this drain on the supply lead to destruction of the forests, with its disastrous effects on the industries dependent on quebracho. A law passed in 1906 requires reforestation of stands of this species, but it is not enforced nor even widely known to be in force. Quebracho reproduces readily from seed and requires no care except protection, especially against grazing. The tender seedlings are relished by stock.

Las Repoblaciones Forestales. Revista Forestal, 3: 1353-1354. 1919.

Is France to Lose Its Oak?

Is oak in France to meet the apparent fate of chestnut in this country? This question is raised in a rather pessimistic article by Doé, who calls attention to the damage done by the fungus oïdium since its appearance in the Province of Champagne, about 1907. While the disease attacks other species, it is particularly partial to oak. It is more virulent and spreads more rapidly in wet seasons, especially during the period from the middle of April to the middle of May, when vegetation is starting. Young trees are most susceptible to attack, particularly coppice shoots of the current year. The shoot is killed back from the top year after year until it finally dies. Seedlings, in spite of the theory as to their superior vigor, suffer fully as badly, if not worse, than sprouts. Cases have even been noted where seedlings as much as ten years old have been completely destroyed. No remedy for the disease has yet been discovered, and even if one should be found the author questions whether it could be practically applied.

In view of the fact that oak comprises nearly 30 per cent of the forest area of France and constitutes its most valuable species, it would indeed be a calamity should Doé's fears as to its possible extermination be

realized. It must be remembered, however, that he is writing from his own experience, which has been confined to the forests of Champagne. For that region he is evidently convinced that the new disease will make the conversion of coppice stands into high forest, always difficult, entirely impracticable. He points out a number of other drawbacks to this system of forest management, which has been so popular in France during the last twenty years, but which he believes to be much inferior to the system of coppice under standards. Until sentiment crystallizes as to the best course to be pursued in the face of the new danger, he recommends that reproduction cuttings in oak stands be omitted altogether or made as light as possible. S. T. D.

La Conversion en Futaie et l'Oïdium, by Fr. Doé. Revue des Eaux et Forêts, vol. 57, 1919, pp. 53-59.

MENSURATION, FINANCE, AND MANAGEMENT

Yield of Conifers

In singing the praises of Douglas fir (the Pacific Coast variety) for reconstructing the depleted forests of France, Hubault quotes from the Report of the British Forestry Subcommittee tables of production of five conifers, partly based on experience in Great Britain, supposedly average performance, timberwood (3-inch) being represented, with a thinning practice, returning every ten years, and varying rotation.

Cubic Feet per Acre

	Douglas fir.	Larch.	Sitka spruce.	Norway spruce.	Scotch pine.
20	100	150	50	....	....
30	300	300	150	100	150
40	500	500	300	250	380
50	600	500	500	380	400
60	7,000	400	600	500	400
70	....	3,540	7,350	600	500
80	....	....	....	6,200	3,230
Totals	8,500	5,390	8,950	7,930	4,960
Av. i.	142	77	128	100	62

Revue des Eaux et Forêts, April, 1919, pp. 75-79.

Government Regulation of Fuelwood in Germany

The scarcity of coal, owing to war conditions, gave rise to a greatly increased demand for fuelwood, while the shortage of labor and the difficulties of transportation resulted in a decreased production. The natural result, had the wood been sold at auction to the highest bidders, as has been

the usual practice, would have been prices so high that people of moderate means could not have gotten fuel. Most of the States, therefore, took measures to restrict the trade in wood, with a view to equitable distribution.

Saxony stopped all fuelwood auctions, and all fuelwood, after supplying the needs of the forest force, was put at the disposal of the communal organizations. Unit prices were fixed for splitwood, while stumpwood and lops were sold at low prices to those who would remove them. In order to increase the amount of fuelwood available, wood less than 10 centimeters in diameter was not allowed to be made into pulpwood, nor could sticks less than 10 to 12 centimeters in diameter be sawed into lumber. Poles could be made only in exceptional cases. Every owner of 10 hectares or more of woodland was obliged to put at the disposal of the authorities the firewood worked up in his forest, and not less than 1 cubic meter (stacked) for every 2 hectares of productive forest soil.

In Prussia all fuelwood had to be sold at moderate prices to the nearby communes, for further distribution to their individual members. Wood auctions were restricted.

In Bavaria all forest owners were obliged, upon notice by the forest authorities, to cut firewood, work it up, and turn it over to the authorities. Wood auctions were forbidden, and for the most important fuelwood centers maximum prices were fixed.

In Württemburg a State firewood office was established. Owners of corporate forests had to cut and turn over 2 stacked cubic meters, private owners 1 cubic meter of firewood per hectare.

In general, the production of fuelwood was regulated in such a way as to abolish or greatly restrict sales by auction, to control the distribution of wood to consumers by the authorities or by special wood-fuel offices, and to establish definite prices, either fixed or flexible.

These measures, while as necessary during the war as the food-rationing measures, have certain rather obvious disadvantages which make it desirable that they be discontinued as soon as possible. Among these disadvantages are: (1) The requirement that a fixed amount of wood per hectare be cut, regardless of the species and other conditions involved, is very hard on some owners, those whose forest is spruce, for instance, while others, such as owners of beech forests, can meet it without difficulty. (2) The real needs of consumers vary considerably with the character of their houses and their social position, and cannot be measured on a per-capita basis. (3) The tree value of wood varies greatly at different times and in different localities, and it is not possible

to fix satisfactory average prices. (4) The efforts to get as much firewood as possible tended to decrease the amount of timber for other uses, which was needed as much as fuel.

Tharandter Forstliches Jahrbuch, 69 Bd., 4 Heft, 1918, pp. 180-183.

UTILIZATION, MARKET, AND TECHNOLOGY

Development of the Turpentine Industry in Germany during the War

In time of peace German industries required each year 82,000 tons of resin, practically all of which was imported. Of course, the war shut off imports except from Austria, which produces some resin; so the Resin Section of the War Committee for Oils and Fats busied itself with the solution of the difficulty by (*a*) organizing distribution so as to conserve supplies, (*b*) introducing substitutes in order to reduce the demand, and (*c*) organizing domestic production of resin.

The principal users of resin products include the following: The paper industry, which uses it for sizing writing paper and the better magazine and book papers. This industry was able to reduce its consumption of rosin by the use of substitutes—a patent rosinless "*Zellkoll-Amal-Leim*" was developed by the committee, which was used in writing paper. Where rosin was used it was used more sparingly, while the decreased production of this kind of paper itself helped the situation. On the other hand, the textile industry made use of large quantities of sized paper for sacks, twine, wagon tops, covers, belts, ropes, "linen," and outer clothing of all colors and patterns. The *cable industry* uses rosin for insulation and electrical transformers contain rosin oil. Now rosin is used only for high tension cables, for which it is considered essential. The soap industry uses rosin entirely in place of fats, since fats are no longer available for this use. *The printers' and lithographers' ink industry* needs rosin for its inks. Coumaron-rosin, a coal-tar derivative made in the production of benzol, was very generally substituted for this use and may be detected by the odor of the newspapers. Brewers, who normally use large quantities of rosin for calking their kegs, were able to decrease consumption by more careful use and elimination of waste. The axle-grease industry uses much rosin, as does the linoleum industry. The varnish industry, which uses turpentine for a drier and a solvent, was taken care of by the use of coumaron products. A number of other uses, such as shoemakers, preservative oils, shell manufacturers, and sealing wax, were

taken care of by the use of pitch distilled from resinous wood, while the sticky-fly paper industry used coumaron.

Domestic production concerns chiefly the pine forests, although a certain amount can be obtained from the spruce.

Under the stimulus of the Resin Section of the committee the turpentining of pine forests was undertaken in many parts of Germany, and many foresters undertook to study the best methods for carrying on the business.

Tubeuf undertakes to explain the origin of the flow of resin, as a basis for organizing production. According to him, the resin, secreted in some manner from the food materials stored in the living parenchyma tissue which lines the walls of the resin ducts, is under pressure due to the turgidity (Turgordrück) of the lining cells. When one of these ducts is cut across, the pressure forces the resin, or "balsam," out, until internal and external pressure are equalized. Meanwhile the opening in the duct becomes sealed up again as the volatile part of the resin evaporates, so that internal pressure is restored and another flow results if the canal is again opened up after a short interval. The resin ducts, which run both vertically with the wood fibers and horizontally with the medullary rays, are all more or less joined up in one system, but the individual ducts are rather short (15 to 70 cm.), so that new cuts are likely to open new ducts and thereby increase the flow of resin. The production of resin depends on the number of resin ducts in the wood. Since these are mostly in the late summer or fall wood, their number is to a considerable degree dependent on the breadth of the rings and the proportion of late wood in them. Living tissue is present only in the sapwood of the pine.

Not only does the secretion of resin by different trees vary very widely, but the yields, even of trees which contain equal amounts of resin, also differ, due to differences in cell turgidity. This turgidity depends on the water content of the tree, which in turn depends on its vegetative condition, on its intake and output of water. These are influenced to a great extent by outside factors, such as temperature of soil and air, soil moisture, humidity. Conifers which absorb no water in winter, but continue to evaporate it through their foliage, are poorest in water and lowest in turgidity in April and the first part of May. The greatest pressure is exerted when, due to soil warmth and moisture, more water is taken in than the leaves evaporate. This occurs in July and August and as late as October. Warm rains and warm sultry periods are especially favorable to abundant flow of resin, while cold spells or hot drying winds are unfavorable. For the same reason,

shade, dense stands, dense undergrowth, and cold sites tend to cause a small flow. The pressure of the outer air tends to counteract the cell pressure; hence on sultry days, when the barometer is low, the resin flow is apt to be copious. Fluctuations in barometric pressure probably partly explain the variations in rate of flow on the same day.

Boxing cuts off the water from below while the drain from above continues, so tends to diminish the flow of resin. The gutter system also has a slight effect of this sort. The boring system, which uses glass flasks inserted in auger-holes to catch the resin, is rather impractical because of the cost of the flasks (particularly under war conditions) and the necessity of boring a great many holes, which can be used but once in each tree. It may be applicable where a particularly volatile resin, rich in turpentine, is obtained, as in the case of silver fir. Tubeuf prefers the system which uses metal strips, either nailed to the tree or provided with prongs which can be inserted under the bark or under paper strips tacked to the bark. He says that these do not interfere at all with the flow of resin, while gutters which are driven into the wood do so.

Dr. Münch, technical adviser to the Resin Section of the War Committee for Oils and Fats, gives the following data on resin yield of the Scotch pine. He uses as a unit for measuring yield the weight of resin obtained from one cut embracing one centimeter of the tree's diameter, wounded once only. Much of the available data on yield are worthless because no allowance is made for the number or breadth of cuts or the number of times that the resin was collected during the season. The depth of cut is not important, since although deep cuts may yield more at first, in the long run they yield only as much or even less resin than shallow cuts. Ordinarily the resin flows for about 24 hours after the cut is made, and another 24 hours is required to fill the canals and restore internal pressure. The cutting can therefore be repeated every two days, and nothing is gained by waiting longer. In his tests the average yield per hundred faces (average width, 12.5 cm.) was 0.89 kg. with a two-day interval between cuts, and 0.88 kg. with a three-day interval. The scrape was not included, but was estimated at about 0.3 kg. in each case; so that the total resin yield was 1.2 kg. per 100 cuts, or 12 g. per cut, or 1 gram per centimeter of circumference. This figure, which agrees fairly well with results obtained by other investigators, is the average for Scotch pine in the German pine region. Individual trees of course vary greatly in their yields, because of differences in climate, soil, site, time of year, weather, size of trees, skill with which the work is done, and other less well understood factors. The

quality of site may be of importance chiefly because the total perimeter per acre is greater on the better sites.

Münch estimates that the average merchantable pine has a d. b. h. of 40 cm. (circumference, 126 cm.), and that two-thirds of the circumference (84 cm.) can be worked. The average season lasts 4 months, or 122 days, making possible 60 "turns" at two-day intervals. At 1 gram per centimeter per "turn," the yield would be 5.0 kg. per tree per season, and with only 40 "turns" it would be 3.4 kgs. On the best sites the trees average 50 cm. d. b. h., which according to a similar computation should yield, with from 30 to 60 "turns" per year, 3 to 6 kilograms of resin. The average hectare with 250 trees should then yield between 750 and 1,500 kilograms of resin per season.

Furthermore, the average production of wood in merchantable pine stands is 4 cubic meters per hectare, which represents a dry weight of about 1,600 kg. To produce 1,500 kg. of resin would probably prevent any growth of wood. It is likely, then, that from 3 to 4 kg. of resin per tree is about all that can be obtained without bleeding the timber to death. This yield is considerably less than that of maritime pine in Germany, which occasionally reaches 3 to 4 grams per centimeter per "turn."

The great variation in yields actually obtained in Germany is stated to be due rather to the method used than to the productivity of the trees. Scarcity of labor prevented cutting at two-day intervals, and because of the abundance of large trees the tendency was to cut many lightly rather than a few up to their capacity. The season was too short for the "adze" method, with little yield before July; with the "groove" method, cutting downward from the original wound early in the season and upward later on, there was a good flow early in May. The flask and boring method of Wislicenus also yields an early flow.

It is stated that by the "groove" method an unskilled worker can easily make 470 meters of cut per ten-hour day (with an average yield of 47 kg.) as compared with the best records of 144 meters for skilled workers with the adze.

He concludes that operators neither in Germany nor in Austria, whence the adze method was introduced to Germany, have ever gotten as large yields of resin as they might. They must both increase the number and breadth of the cuts and utilize the groove (or "streak") method, introduced from America, with the modification that the cutting should proceed downward during the early part of the season.

Dr. Kienitz notes that Scotch pine yields less resin than black (Austrian), maritime, longleaf, or several other pines, while its wood is

fully as valuable as that of most pines, so that considerable care should be exercised in selecting a method of working which will yield the maximum amount of resin with a minimum of injury to the tree.

Narrow faces yield more resin per unit of width than do broad ones, so that in theory several small cuts would be preferable to one large cut. But the work is increased by increasing the number of cuts, more receptacles are required, and more turpentine is lost by evaporation from the relatively greater surface over which the resin has to flow, so that in practice the larger cut is preferable.

The adze method, which is used in Austria, was the first method tried in Germany. Splettstösser then introduced the groove method as practised in America. This has the advantage that the wound is smaller, the flow is quicker and consequently evaporation less, and the faces can be worked either upward or downward. Splettstösser originally spaced his successive grooves several centimeters apart, in a "herring-bone" pattern, but the American method, which leaves no interval between cuts, is better, because it makes it possible to work for four years on a face which the herring-bone method would cover in one.

The Americans, working their faces upward, get less resin than if they reversed the direction. Kienitz' experiments indicate a yield 50 per cent greater by working downward. He thinks this due partly to the less likelihood of loss through evaporation and overflow.

While flasks to catch the resin save much turpentine which would be lost by evaporation from more open receptacles, they are expensive, difficult to empty, and apt to fill with water. Open receptacles will probably be used more for the present.

Forstmeister Aueroch describes the results of his experiments in the Schöllkrippen district. Regarding technique, he discusses the trial of various tools and equipment and concludes that tins driven into grooves in the tree are more satisfactory than the "swallow-nests," which are attached to the outside of the tree, since the latter are subject to excessive breakage. Removal of the outer bark (*Rötung*) preparatory to cutting the grooves should not be done until just before working begins, because increased evaporation or decreased bark pressure, or both, result in decreasing the flow of resin.

He makes the following notes regarding the influence of various factors on the flow of resin:

1. *Age of stand.* The stands studied were from 65 to 100 years old. There seemed to be no difference in yield due to age.

2. *Rate of growth.* His experience was contrary to generally accepted theory, that quick-growing trees yield more than those of slow

growth. In this case a slow-growing 65 to 66-year-old stand, with average d. b. h. of from 20 to 22 cm. and heights of 15 to 16.5 m., gave the greatest yield, while the thriftiest stand, 89 to 100 years old, with average d. b. h. of 32 cm. and height of 23 m., gave only a moderate yield for the same dates.

3. *Mixed stands.* There was no apparent difference due to mixtures of other species, such as spruce and birch.

4. *Site conditions.* (The area studied did not cover enough different conditions to draw general conclusions.)

(*a*) Soil. The yield was greater on sandy soil than on those which contained considerable clay, due, perhaps, to the warmer character of the sand.

(*b*) Exposure. No conclusions because of insufficient data.

(*c*) Slope. The yield was greater where the slope allowed the sun's rays to penetrate.

(*d*) Altitude. The yield seems to decrease with altitude, due perhaps to decrease in soil temperatures.

5. *Meteorological conditions:*

(*a*) Atmospheric pressure. This is an important factor. The air pressure opposes the internal pressures which force the resin out, so the lower the barometer the greater the flow of resin.

(*b*) Air temperature. The flow tends to increase with increase in temperature, except that on hot, dry days the resin may harden and stop the flow.

(*c*) Humidity. The flow is greatest on sultry days.

6. *Frequency of working.* The ducts become stopped up with hardened resin within 24 hours, and 24 hours more is required to restore the original pressure. Cutting should therefore be repeated every two days, and the resin harvested at the end of the first day after cutting, so as not to lose part of it by evaporation.

7. *Distribution of work.* Where possible, stands should be worked in units of such size that loss of time due to travel is avoided. There should be enough laborers to work the stands regularly at two-day intervals. One person can cut about eight hundred faces per day.

Forstmeister Koehl, of Trippstadt, contributes the following to the discussion of methods of turpentining. His experiments were made on a 25-hectare tract of 99 to 103 year-old Scotch pine, partly mixed

with beech, which had been boxed in 1916. He tried the bore method with flasks (Wislicenus) and the groove method. The disadvantage of the first are the lower yields and the greater cost. The resin obtained by this method cost 2.21 marks per kilogram for labor, as against 0.46 marks by the other method. The bottles are hard to empty and are liable to excessive breakage. It was necessary to suspend operations during the huckleberry season, because the children stole and broke so many bottles. It may be possible to improve the method by developing a machine to do the boring and by using cylindrical flasks. The method requires a fairly thick, firm bark to hold the bottles.

The groove method showed larger yields by grooving the old faces together with working the new area above than by the new grooving alone. The work was done by girls working in pairs. Two girls can make from 2,000 to 2,300 original grooves per day, or from 2,400 to 2,600 of the "follow-up" grooves.

Wislicenus admits that his method, which uses flasks set in auger-holes, produces less resin than Splettstösser's groove method, but asserts that it is greatly superior in quality. The resin obtained yields from 33 to 35 per cent turpentine, as compared with from 22 to 27 per cent by the groove method. The resin caught in bottles is clean, melts quickly, and stays liquid a long time, while that caught in open receptacles loses considerable turpentine by evaporation, melts slowly, and resumes a tallowy consistency within a day. It is also liable to become mixed with insects, twigs, needles, pieces of bark, and rain-water.

The auger-hole method may be improved upon, but even as it is it has the advantage of doing away with the preliminary removal of outer bark, which the other method requires. It is more sparing of the tree, and the entire operation can be carried on by women and children. Holes, which should extend from 1 to 3 centimeters into the wood, do not seriously injure the value of the tree for lumber. The yield per tree is bound to be less, because the aggregate amount of cut surface by this method can be only about half as much as that by the other method.

Forstmeister Gundel says that the auger-hole method yields less but better resin, but that it requires holes at least 12 cm. deep to hold the bottles, and that deep holes spoil part of the lumber in the butt of the tree. The adze method has had its day and should be replaced everywhere by the groove method, which involves less work and yields more. With the general adoption of this method the question of good and cheap receptacles for catching the resin will be very important, since

an area of 4,000 hectares, for instance, with 200 trees per hectare and 2 faces per tree, will require 1,600,000 cups. Under present conditions the cost of cups exceeds all other outlay combined. The "swallow-nest" tins, which were tried, proved unsatisfactory because of poor material and defects in manufacturing. Square (right-angled) metal troughs driven into notches in the trees were just as good for the adze method. It is suggested that cheap wooden cups may be devised.

Biehler of Rastatt reports the following results of his studies of working Scotch pine:

1. *Influence of size of crown.* In general the better developed the crown, the better the assimilation and nourishment and consequently the yield of resin. There was, however, great variation in yield of individual trees, irrespective of crown development. About one-fourth of all trees were good yielders, three-fourths poor. The proportion of good yielders increased with d. b. h. and with development of the crowns. Thirty-two per cent of full-crowned trees were moderate or good yielders, as compared with only 19 per cent of the thin or small-crowned trees. The following table shows the classification by classes and yield of resin:

Crown class	Normal full crown			Medium crown			Poor crown			Average		
Resin class	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor
Per cent of all trees in each crown class	19	13	68	11	12	77	5	14	81	14	13	73

2. *Influence of soil.* There was a marked difference in yield due to differences in depth of soil. The best yielders were those whose roots were in the deepest soil; those with roots mostly in a gravelly subsoil gave poor yields. Yield potentiality may be judged to some extent by crown and soil. The appearance of the needles is also important as an indicator. Full, succulent green foliage generally (not always) indicates good yield; thin, yellowish foliage generally indicates the reverse. Simple and sure indications by which the potential yield of individual trees may be judged are of great importance to the industry, since by this means the working of poor yielders may be avoided.

3. *Influence of number of faces.* The yield increases with the proportion of circumference which is worked, up to certain limits, except as modified by unfavorable exposure or other factors. It is best to use from 1 to 3 faces, according to size of trees.

4. *Influences of depth of cut.* One group of five trees was cut to a

depth of two annual rings, or about ¼ cm., and another group of five trees of about the same normal yield of resin was cut 5 rings deep, or ½ cm. The yield per face per "turn" for the first set was 15.8 grams, as against 10.8 grams for the second set—a ratio of 1 to 0.68. In general, for the first two years the cuts should not much more than open up the surface, while later cuts should cut through as many rings as the number of years the tree has been worked.

5. *Influence of method of holding the adze.* A cut perpendicular to the bark gave 36 per cent less yield than an oblique (30°) cut and 30 per cent less than a flat (10°) cut. An oblique cut is harder to make, since it is almost sure to go too deep; so the flat cut is considered best.

6. *Influence of periodicity of working* (Nachdechseln). The 1916 instructions of the Resin Committee called for a 4 to 5 day turn, while the 1917 instructions called for a 2-day turn. The writer says that during the warm part of summer cuts should be repeated even more frequently. Good yielding trees give up four-fifths of their flow in from 2 to 3 hours. The period should be varied according to the weather and time of the year. Possibly a three-day interval would suffice early in the season, later reduced to two, and then to one in the hottest part of the summer, and then gradually increased to three days again.

7. *Influence of time of year, temperature, and weather conditions.* In spite of the fact that October, 1917, was abnormally cool, moist, and cloudy, with low atmospheric pressure, the yield of resin in that month was almost as great as that in September, which was the highest month. Good yields, better than any up to the middle of July, persisted until the middle of November. The flow must, then, be influenced by other factors to a much greater extent than by temperature conditions, which by some have been considered the most important factor. The writer believes that the production of resin is a by-product of metabolic assimilation, which is most active in the fall of the year.

8. *Influence of the irritation caused by scraping.* Although only a small additional quantity of resin is obtained by scraping the cuts, it is desirable to do this to keep the surface smooth and thereby insure quicker flow and less loss by evaporation. Moreover, the scraping seems to stimulate the production of a secondary resin flow from pathological resin ducts. This may be because it stimulates division of the cambium cells, which, according to Mayr, causes the formation of resin ducts, due to internal stresses and tension. The effect of the wound irritation reaches, on the average, 6 cm. above and 2½ cm. below the

cut and sometimes double the distance (Tschirch). Scraping can often considerably increase the yield of poor yielders. Biehler's conclusion is that the method of working has the greatest effect on resin yield, while uncontrollable factors such as soil and weather are of secondary importance. Much further study is needed to develop the proper technique.

The Resin Section of the War Committee for Vegetable and Animal Oils and Fats (Kreigsausschuss für pflanzliche und tierische Öle und Fette, Rohharzabteilung) published a somewhat detailed memorandum of suggestions and instructions for the production of resin during the season 1918. The American groove (Risser) method is recommended, with cuts embracing two-thirds of the circumference of the stem (or twice the diameter), except that trees to be cut the next year can be worked more intensively. Faces should be prepared by removing the outer bark from the ground to one meter high. Trees to be worked on only one side should be cut on the northeast to protect against sun, wind, and rain, and also because the rate of growth, and consequently the yield, is apt to be greatest on that side. In grooving, a plumb-bob should be used to get the center groove vertical. The grooving knife should be sharpened with a whetstone every hour. Either of two forms of grooving may be used: (*a*) The herring-bone (Splettstösser) system, leaving a narrow space between successive grooves; (*b*) the American system, which cuts along the edge of the previous cut. (The cutting from below upward, as is done in America, is more wasteful of resin than cutting from above downward.)

The committee states that it is uncertain which of the two methods is the better, but it is believed that the herring-bone method gets more resin with the least work, while the American method allows longer working of the same tree and therefore more resin in the long run. The extensive use of the first is recommended in order to get quick results on account of war needs.

The best yield is from downward working during the first 4 to 8 and in some cases 8 to 12 weeks; therefore the first cut should be made about 60 cm. from the ground, and following cuts during the next 4 weeks or so should be made below it. Later (the time to be determined by trial) cuts may be made upward. If convenient, a 30-cm. strip should be left at the bottom to start the second year with.

While grooves 1 cm. deep in the wood yield slightly more at first, shallow cuts, which are easier to make, yield as much in the long run. Cuts from 2 to 5 mm. deep are recommended. A two to three days' interval between cuts is recommended for warm weather, and four to five days in cool, damp weather.

The resin should be gathered in pails and put into kegs. Since the supply of kegs is short and cannot be replaced at this time (1918), they should be used carefully. Staves and hoops should be kept tight and empties should be stored in cool places to prevent excessive drying.

Cutting by the groove method should start early in May or even late in April. Cutting with the adze does not yield results until late in June. Operations may continue to October.

Organization of the work and rates of pay are important. There are not yet available (1918) sufficient figures as to what workers should accomplish in a day. Two women ought to do all the work on from 1,500 to 2,000 trees. Barking should be paid for according to area barked, the other work according to the kilograms of resin obtained. Women and school children can do all of the work.

Schepss recites the results of experiments made in the spring of 1918 near Wurzburg. The yields of 39 selected Scotch pines worked by a number of different methods and combinations of methods were studied. The study showed the following:

(1) Good yields were obtained as early as March and continued in excess of the 1-gram per centimeter per "turn," which had been suggested as an average yield, during the period of the study (through May). (Weather conditions during this spring were unusually favorable.)

(2) Working downward yielded more than working upward, although upward working yielded some resin, even in the first of the season.

(3) The American method, working downward instead of upward, yielded more than the herring-bone method.

(4) Cutting both above and below at the same time gave almost twice as much resin as cutting on one side only, so may be used on stands which are to be cut soon afterwards.

(5) There is no particular advantage to be gained by freshening old cuts, except perhaps in case of premature stopping of the flow.

(6) Stems worked the previous year yielded on the average 50 per cent more than new trees. (A few on heavy clay soil yielded less.)

(7) The author, even though handicapped by a wounded foot (received in battle), was able to cut 800 pairs of grooves per day.

(8) The shady sides of the trees yielded more than the sunny sides. The highest average yields came from the northeast faces.

(9) Although the rapidity of flow differed very widely in different trees, on the whole 95 per cent of the total flow ran out within 19 hours after the cut was made. It is believed that morning is the best time to

cut, since the warmth of the day can then exert its influence on the flow before the cooler temperatures of night check it.

(10) Indications were that in general the best yields came from the thriftiest trees, although this was not true in all cases.

(11) If the yield during the season kept up as well as it started, he figured that he should get 3.3 kg. per tree, or, with about 350 trees per hectare, at least a ton (metric) of resin per hectare.

Tubeuf discusses the working of spruce for turpentine, which has to follow methods somewhat different from those used for pine. The resin of the spruce is almost all from the secondary, or pathological, ducts formed as a result of wounds to the bark and cambium. These ducts are formed in the first layer of the callus which grows over the wound and in the new annual ring adjacent to the edge of the wound. They follow injury by frost, lightning, and drought cracks, as well as other wounds. Much of the resin in wild stands is due to injuries by game. The yield is small the first year and greatest the second after wounding, so that the first harvest is made at the end of the second year.

The following points are noted:

(1) *Choice of stand to work.*

(*a*) Age. Only stands to be cut at the end of two years should be worked. Thick-barked trees should not be worked.

(*b*) Situation. Middle elevations, warm coves, and warm soil give better yields than high rocky sites on cold soils.

(2) *Wounds.*

(*a*) Time of wounding. Should be done when the bark slips, or during May and early June. On cold sites, at high elevations, in the shade, in dense stands, cutting should be done later than on more favorable sites. There is as much as three weeks' difference between north and south slopes in the same locality.

(*b*) Length of wound. The yield is proportional to the length; two meters is the most convenient length to work from the ground (cuts run vertically up and down the tree). It is usually not convenient to run the cuts clear to the ground, because of the necessity of stooping to gather the resin.

(*c*) Breadth of wound. A comparatively narrow wound is as good as a wide one, since the yield depends on the length rather than on the breadth of the cut. Narrow cuts do not dry out so quickly, and more can be made on one tree. The

best width is between 3 and 5 centimeters, which can be scraped easily and is not covered too quickly by the callus. Resin production ceases as soon as the wound is closed.

(*d*) Exposure. There is no apparent difference in yield from the different sides of a tree, but direct sun on the cut causes it to dry out quickly and thus hinders resin production.

(*e*) Number of wounds. There is no objection to four cuts on the same tree at once. How many more may be made is not known.

(*f*) Tools for cutting. A strong garden knife or pruning knife is all that is needed. The wound consists only in peeling off a long strip of the bark without injuring the wood.

(*g*) Choice of trees to work. Only those from which bark cuts and strips off easily should be worked.

3. *Gathering the resin.* (*a*) Time to gather. Production continues to the end of September or early in October if the weather is warm. The resin may be gathered after production ceases, or, if there is no danger of its being stolen, it may be left until the following spring. A considerable quantity of resin is produced the second year, and should be harvested the same fall, during warm weather, because in cold weather it becomes so brittle as to fly all around when scraped. Not only is much lost in this way, but it injures the eyes of the workers.

4. *Yields.* From sample plots cut in 1916 and harvested in May, 1917, the yield per cut varied from 18.35 grams for cuts 1 meter long by 5 centimeters wide to 35.04 grams for cuts 2 meters long by 5 centimeters wide, or, roughly, .035 gram per square cm. The resin was gathered again in October, 1917, and the total yields for the year (two crops) averaged 0.1 gram per square cm.

5. *Effect on health of tree and quality of wood.* In case of pine, the resin impregnates the wood below the wounded surface and prevents drying and the entrance of fungi. It does not do this in the case of spruce, since the wound affects only the bark and the layer of new wood, where there are no vertical resin ducts and few horizontal ones. Little resin exudes, but the face of the cut is dampened by sap and becomes a fertile breeding ground for fungi. The wood below the cut dries out clear to the heartwood, and the substitution of air for water in the cells allows the entrance of wood-destroying fungi. Moreover, small checks produced by drying also favor the entrance of fungi. Discoloration of the wood with fine mycelium in the parenchyma tissue of the medullary rays and tracheids follows, often as early as the second summer. In the earliest stages the wood is not particularly

injured, since the outer sapwood is mostly slabbed off in milling, but as time goes on the action of the fungi destroys the tissues. The process may continue in the mill yard in case of logs and is stopped only by prompt sawing and drying, and may even start again if the wood is used in a damp place.

The question of whether spruce shall be worked for its resin can only be decided after studying its effect on the lumber trade. At any rate, it will probably be best to work only trees which are to cut in two years, and to work them as severely as possible (Totharzen).

W. N. S.

Tubeuf: Die Verwendung des deutschen Harzes. Naturwissenschaftliche Zeitschrift für Forst- und Landwirtschaft. January-February, 1918, pp. 67-70.

Tubeuf: Uber die Beziehungen der Baumphysiologie zur praktischen Harznutzung. Ibid., pp. 1-17.

Münch: Das Harzerträgnis der gemeinen Kiefer. Ibid., pp. 18-27.

Kienitz: Versuche über den Einfluss der Art der Verwendung auf den Balsamfluss der gemeinen Kiefer. Ibid., pp. 61-67.

Aueroch: Untersuchungen und Erfahrungen bei der Harznutzung 1917. Ibid., pp. 35-43.

Koehl: Untersuchungen über verschiedene Verfahren zur Harzgewinnung. Ibid., pp. 43-53.

Wislicenus: Zur deutschen Kiefernterpentingewinnung mit geschlossenen Bohrungen und Harzbeuteln. Ibid., pp. 53-61.

Gundel: Harznutzung 1917. Ibid., pp. 28-35.

Biehler: Zur Harznutzung im Jahre 1917. Allgemeine Forst- und Jagdzeitung, August, 1918, pp. 149-165.

Kriegsausschuss, etc.: Die Kiefernharznutzung 1918. Naturwissenschaftliche Zeitschrift, January-February, 1918, pp. 70-78.

Schepss: Zur Kiefernharznutzung 1918. Ibid., March-August, 1918, pp. 105-118.

Tubeuf: Hartznutzung der Fichte in Grafrath. Ibid., January-February, 1918, pp. 78-98.

Game Prices in Germany

Game in Germany has always been an important item in the meat market, some 15 to 20 million pounds being the annual output, which, since game is administered as carefully as the forest itself, remains from year to year the same. In the effort to husband all provisions and to prevent speculation in food materials, the government has, since December, 1915, set price limits for wholesale and retail sales of game. The wholesale and the consumer's prices are:

Stag in pelt, per pound, 15 cents and 36 cents.

Roe in pelt, per pound, 17 cents and 45 cents.

Wild boar, in pelt, per pound, 13 cents and 27 cents.

Hare in pelt, per piece, 90 cents and $1.25.

Rabbit in pelt, per piece, 24 cents and 40 cents.

Pheasant in pelt, per piece, 60 cents and 84 cents.

The government of Berlin issued special schedules for different parts of game animals, which vary for the various cuts, from 12 cents up to the maximum for stag and roe and from 7 cents up for boar meat.

Allgemeine Forst- und Jagd-Zeitung, January, 1916, p. 19.

STATISTICS AND HISTORY

The French Forest Service in the War

An interesting account of the activities of the Administration of Waters and Forests during the war is given by a member of the administration who signs himself "X," in answer to various criticisms as to the use made of the forest personnel. The author points out that the part actually played by forests and foresters was different from that which had been expected of them. As a result of the war of 1870, it was unanimously believed that another war would be short, that the forests would have no great strategic value, and that foresters could best be used as a part of the army, with the exception of the personnel necessary to prevent trespass in the forests in the interior of the country. Consequently when the war broke out most of the forest officers took their places in the various military services, and it was with difficulty that a sufficient force was retained to handle the necessary routine work.

By the beginning of 1915 trench warfare had replaced the war of movement, and the needs of the army for wood gradually but steadily increased. At first each of the various military organizations in the zone occupied by the army secured its wood, without reference to any other, from the most convenient stands, and without regard to their future. Recognizing the danger to the forests of such a course, the Minister of Agriculture succeeded in securing the creation of an Army Forest Service (Service forestier d'Armée), which with certain modifications continued its activities throughout the war. This service was composed entirely of foresters and was charged with the supervision of all exploitations of the forests within the zone occupied by the army.

Back of the lines, in the interior of the country, there was also an entire lack of co-ordination, each service securing wood to meet its needs without reference to any other service. The engineers, for example, were especially interested in softwoods, the artillery in hardwoods, the railroads in ties, the quartermaster corps in fuel, and the aviation service in woods of special importance for airplanes. The engineers had gone so far as to divide France into eight districts, known as "Centres des Bois," each with an organization for securing the necessary wood

supplies. This chaotic situation was somewhat difficult to remedy, because the army wished to retain control and was jealous of any apparent encroachment by other agencies in matters which it considered under its jurisdiction. Gradually, however, the Director of Waters and Forests succeeded in attaching a considerable number of technical foresters to the various services supplying wood for the army.

The next problem was to bring about the unification which was evidently necessary if there was to be a rational utilization of the forests. The first step in this direction was the organization, on May 4, 1917, of a General Committee on Forests, which was charged with general supervision over all matters relating to the utilization of the forests. On July 3, 1917, this was transformed into the General Committee on Wood (Comité général des Bois), which was charged with a similar supervision over all matters relating to the utilization of wood as well as of forests. In addition to the General Committee on Wood, the actual conduct of the necessary operations was centralized in a General Inspection of Woods (l'Inspection Générale des Bois), which was placed under the Minister of Munitions, a former director of engineers.

While foresters were predominant in the new organization thus created, they did not have a free rein and were not always consulted on important matters. Private forests suffered chiefly through mistakes made in this way, since the national and communal forests were protected by the Administration of Waters and Forests. Operations by the British and American forces are said to have been particularly unfortunate in this respect, because of their natural lack of detailed knowledge regarding cultural and economic conditions. Vigorous complaints as to the exploitation of the private forests in the Landes resulted in the creation of a commission at Bordeaux to pass on all proposed cuttings in this region. An inspector general in the Administration of Waters and Forests also conducted an investigation of operations there which resulted in a recommendation that supervision of all the work connected with the securing of wood supplies be placed under the Director of Waters and Forests. This request the Minister of Munitions declined to accede to. Finally, however, a compromise was reached, on July 4, 1918, by which foresters were given a complete preponderance in both the administrative and technical services. In addition, the Minister of Agriculture appointed a representative to keep in touch with the work relating to the supplying of wood for the national defense and for the allied armies and to perhaps take whatever new measures might be necessary to safeguard the future of the French forests. This in turn was followed by a decision to make a complete

inventory of the available resources throughout the French forests, an important work which is being carried on exclusively by foresters. The value of the inventory has not been decreased by the signing of the armistice, since the information being secured is necessary to determine the extent to which the French forests can safely be drawn upon in the days of reconstruction ahead.

In conclusion, the Administration of Waters and Forests claims that, in spite of the disorganization which resulted in the first days of the war, it has succeeded in maintaining its own progress and in safeguarding the future of the French forests without preventing the army from securing all the wood needed for military purposes.

S. T. D.

L'Administration des Eaux et Forêts pendant la Guerre, by "X." Revue des Eaux et Forêts, vol. 57, 1919, pp. 45-52.

POLITICS, EDUCATION, AND LEGISLATION

The German Civil Service Federation

This federation was founded in Berlin on December 4, 1918. It includes the various unions of civilian employees. Its field of activity covers:

1. The matters concerning the civil service in general.
2. Questions relating to different branches of the service, which have a general interest.
3. Economic and political matters.
4. Deliberations of the bodies which compose it.

Questions relating more closely to individual branches of the service are left to the unions concerned.

Deutsche Forstzeitung, 34: 1, 1919.

Training Forest Apprentices

Foresters have long felt that the existing methods of training forest apprentices were unsatisfactory, but their often-repeated protests have gone unheeded. Now times have changed, and they hold their fate, more or less, in their own hands.

It is most desirable that apprentices be trained by foresters (förster) instead of by oberförster, as at present. The present training fits them more for the work of an oberförster than for the work they will actually have to perform. Moreover, it is a book-training, not the training in the woods which they would get under a forster. Since there are some 4,000 forster and only 150 apprentices taken on each year, it will be

easy to select those forster who are best able to give the required attention to the training. School education should be completed before undertaking the forest work.

In order for Germany to regain her place in the sun, very hard work will be necessary on the part of every one, including the foresters. Even in forestry, new methods will be devised to produce maximum results with a minimum of effort. The scientists have to devise the methods, but the foresters will have to apply them. The hunt will play but a small part in the forester's life, for he will have no time for it. All his thoughts and efforts will be devoted to forestry.

The separation of the forest service from the military service is a matter of a few months at the most and will remove the greatest obstacle which has been in the way of the progress of the forster class. This will allow the forster more time for the training of apprentices.

Finally, the course in the forest schools should be lengthened to two years.

Linck. Forstlehrlinge. Deutsche Forstzeitung, 34:29-32. January 19, 1919.

Prussian Forestry Profession

Representatives of all the Prussian ranger (Jäger) battalions met in Berlin on December 20-21, 1918, to consider matters affecting the forestry profession.

In addition to presenting several propositions for immediate consideration by the Ministry of Agriculture, Domains and Forests and by the Branch of the War Office in charge of rangers and riflemen (Jäger and Schutzen), they adopted a platform expressing their minimum demands in the reorganization of the State service. These demands include the following:

Complete separation of the forestry profession from military control, with certain provisions regarding the reabsorption of service men into the civil service; change in course of training for foresters, with a limitation on the number of students admitted and with a preference in favor of foresters' sons; the training to include a year's practical work with a forester and two years in a forest school; after passing an examination, to be given by foresters, the legal military service period is to be undertaken, after which the candidate should be immediately given a place in the State forest service, unless he wishes a furlough to enter private work. Every forester shall have a chance to study, with the support of the State, for a higher position; salaries shall be adjusted so that a man reaches his highest salary in middle life; maximum pensions and widows' allowances in case of disability or death to be

paid, regardless of age or length of service; more foresters' positions to be created, and in no case shall the present number be reduced through consolidation of forest units; forest dwellings to be built, even for the youngest forest officers, and allowances for rent to be paid them until buildings are ready; cost of moving to be paid by the State; forest administrative officers shall co-operate and have a deciding voice in drawing up revised forest service instructions; secret personnel records shall be abolished and all such records opened to inspection at any time.

Tagung der Vertreter der bei den Jäger-Battailonen auf Forstversorgung dienenden preussischen Forsteranwärter. Deutsche Forstzeitung, 34: 12-21. January 12, 1919.

Private Forests and the State in France

The law of July 2, 1913, made it possible for private owners voluntarily to turn over to the State the entire management of their forest lands. Great hopes have been entertained that this law, the practical operation of which has been postponed by the war, will result in the better handling of private lands, which include two-thirds of the wooded area of France. The decree of November 26, 1918, regarding the application of the law, appears to indicate that local forest officers will be given a fairly free hand in the management of woods turned over to them. Guyot feels that considerable freedom in this respect is absolutely necessary because of the widely varied conditions that will be met, and fears that any attempt to enforce hard and fast regulations would result in discrediting the law. Guyot also expresses the hope that a considerable part, if not all, of the sums paid by private owners for the public management of their lands will be turned over to the local forest officers to recompense them for the additional work involved. S. T. D.

Jurisprudence, by Ch. Guyot. Revue des Eaux et Forêts, vol. 57, 1919, pp. 60-62.

Overcrowding of the Forestry Profession in Prussia

Alarmed by the serious overcrowding of the private forestry profession in Prussia, the head of the union of private foresters has appealed to the Minister of Agriculture and Forests to find places in the State service for men released from the army. He says the ranks of private foresters have been overfilled in spite of constant warnings by the union ever since 1903. It was hoped that losses due to the war, together with increased opportunities in the East, would remedy the situation, but the unfavorable outcome of the war prevented this east-

ward development. The foresters employed in Poland had to flee without even their personal belongings and are now looking for positions, as are many foresters released from the army.

Deutsche Forstzeitung, 34: 1, 1919.

Reopening of Forest Schools in Germany

In October, 1918, the forest academy at Eberswalde reopened after a four-year suspension. Up to Christmas 80 students had enrolled and more were expected later on. The forest academy at Münden is to open with the summer semester, 1919. The Saxon forest school at Tharandt opened in January, 1919, with a short winter term for those students returning from the front who had already completed their first or third half year, and is to resume fuel courses with the summer term.

Deutsche Forstzeitung, 34: 1, 1919.

MISCELLANEOUS

Fruit Trees Along Public Roads

In ten years the Hungarian Government nurseries have supplied gratis or at reduced prices some 69,000,000 fruit trees for planting along the State roads. It is hoped that within the next three or four years all of the 80,000 kilometers of road will be planted up. In each district only one kind of tree is planted, which facilitates the sale of the fruit. The clergy and school teachers are instructed in fruit-culture and are expected to pass this instruction along. Within a short time it is expected that the sale of the fruit will more than offset the cost of maintaining the roads.

In Württemburg the annual production of roadside fruit trees is valued at 20 million francs.

In France and Belgium the State and private individuals plant fruit trees along the public roads.

In Paraguay many roads are lined with orange trees.

El arbolado en los caminos publicos. Revista Forestal, 3: 1331-1332. 1919.

EDITORAL COMMENT

THE A. F. L. FAVORS RESEARCH

The American Federation of Labor adopted the following resolution at its Atlantic City convention:

WHEREAS scientific research and the technical application of results of research form a fundamental basis upon which the development of our industries—manufacturing, agriculture, mining, and others—must rest; and

WHEREAS the productivity of industry is greatly increased by the technical application of the results of scientific research in physics, chemistry, biology, and geology, in engineering and agriculture, and in the related sciences; and the health and well-being, not only of the workers, but of the whole population as well, are dependent upon advances in medicine and sanitation; so that the value of scientific advancement to the welfare of the nation is many times greater than the cost of the necessary research; and

WHEREAS the increased productivity of industry resulting from scientific research is a most potent factor in the ever-increasing struggle of the workers to raise their standards of living, and the importance of this factor must steadily increase, since there is a limit beyond which the average standard of living of the whole population cannot progress by the usual methods of readjustment, which limit can only be raised by research and the utilization of the results of research in industry; and

WHEREAS there are numerous important and pressing problems of administration and regulation now faced by Federal, State, and local governments, the wise solution of which depends upon scientific and technical research; and

WHEREAS the war has brought home to all the nations engaged in it the overwhelming importance of science and technology to national welfare, whether in war or in peace, and not only is private initiative attempting to organize far-reaching research in these fields on a national scale, but in several countries governmental participation and support of such undertakings are already active; therefore be it

Resolved by the American Federation of Labor in convention assembled, That a broad program of scientific and technical research is of major importance to the national welfare and should be fostered in every way by the Federal Government, and that the activities of the Government itself in such research should be adequately and generously supported in order that the work may be greatly strengthened and extended; and the Secretary of the Federation is instructed to transmit copies of this resolution to the President of the United States, to the President *pro tempore* of the Senate, and to the Speaker of the House of Representatives.

LABOR AND SCIENTIFIC RESEARCH

"This is convincing evidence of clear thinking," was the comment of Col. Henry S. Graves, Chief of the Forest Service, when asked his

opinion as to the resolution advocating a broad program of scientific and technical research and its generous support by the Federal Government, which was adopted by the American Federation of Labor at its recent convention in Atlantic City. "This resolution makes it seem a far cry to the time when working-men manifested their suspicion of inventions by destroying labor-saving machines. Increasingly labor is recognizing that research is not only not inimical to the welfare of the worker, but is actually essential to it. In the last analysis it is research that will make possible the realization of labor's just demands for better opportunities and better living conditions. For if these demands are not to be merely a case of robbing Peter to pay Paul, the industrial changes which they involve must be accompanied by increased efficiency of production. Improved appliances, new methods, closer utilization of raw materials, are all necessary to meet the new conditions of industry. The worker will be the first to be benefited. These improvements are dependent on research.

"Take, for example, the case of forest products. As a result of laboratory investigations, followed by commercial demonstrations, it has been proved that several kinds of wood hitherto regarded as valueless for the purpose can be substituted satisfactorily for spruce in the manufacture of pulp and paper. Again, improved methods have resulted both in the time required for the artificial drying of wood and the loss formerly resulting from it. These, like other improvements and factors that increase the efficiency of production, introduce economies from which the laborer in the long run should benefit.

"In the field of forestry a direct and great benefit to the workers must come from the scientific handling of the forest resources themselves. Altogether there are a million or more wage-earners who, with their families, are dependent for a livelihood on the forest and wood-using industries. If these industries are to survive, the forests must be protected and perpetuated. But the forest is as much a crop as any other product of the soil and therefore is profoundly affected by climate, soil, and many other factors. If it is to be handled so as to yield good returns its management must be based on principles that have been developed by intensive investigations both of the life and behavior of the trees themselves and of their relation to their environment. More and more we must look to making the forest industries permanent and stable. If forest establishments can be assured of continuous raw materials, we have the opportunity for better living conditions than exist in many places today; the opportunity to bring about steady employment and a home, in contrast to the nomadic life characteristic of

a part of our forest workers. Here again research must point the way toward handling the forests as a renewable resource on a permanent basis.

"What is true in forestry is, of course, equally true in all other lines of activity. Everywhere scientific research, adequately encouraged and supported by enlightened public opinion, must take the lead in bringing about improvements that will contribute to the welfare of the people in general and of the worker in particular. When the worker by hand sees in the worker by brain a true collaborator who works not for the benefit of a few but for the benefit of all, science will effectively render a high social service. It is most encouraging that the leaders of the labor movement in this country should have so unequivocally recognized this fact."

An Independent American Federation of Technical Workers

The editorial in the April issue of the Journal, "Why not a Union for Foresters?" contains the germ of a big idea.

W. S.'s reply, proposing a "National Federation of Technical Workers," contains the germ of an even bigger idea.

But W. S., in my opinion, interjects a fundamental error when he proposes that his "National Federation of Technical Workers" affiliate itself with the American Federation of Labor.

I had better say, in the first place, that I am not opposed to organized labor. On the contrary, I am for it. Neither can I plead guilty to "white-collar" snobbishness, though realizing the prevalence of some such malady. But W. S. overlooks the real power in his own idea when he proposes to join hands with labor. The real power in a federation of technical workers lies not in an alliance with labor, nor yet with capital, but in holding the balance of power between labor and capital.

What is the real predicament of the technical worker today? It is this: Organized capital is raising prices to offset the wages exacted by organized labor. Organized labor is raising wages to offset the prices exacted by organized capital. The unorganized technical worker pays both, but controls neither. And this in spite of the fact that the net gains made by either side come either out of his head or his pocket. Why? Because there can be no absolute net gain, either in prices or wages, except through (1) increased efficiency of production, which is largely made possible through the inventions of technical men, or (2) a net loss to a third party, which pays the increased cost of living without increased remuneration. We all know the identity of the third party in question. It is the technical worker.

Why, then, an independent American Federation of Technical Workers? Because:

1. It is the right and only way to procure for the technical worker his equitable share in the products of industry.

2. It is the right and only way to restrain the excesses of both capital and labor.

3. It is the right and only way to restrict the endless and aimless increase of wages and prices, and to limit such increases to net gains made possible by greater efficiency of production.

There could hardly be three arguments more powerful than these, nor three social objectives more to be desired; but, in addition, there is a fourth objective which should by no means be overlooked: a federation of technical workers could go a long way toward ironing out the petty jealousy, prejudice, and intolerance which in many instances are dividing and retarding the professions and intra-professional schools of thought. Last, but not least, such a federation could stimulate recognition of the social value, as well as economic value, of technical and professional service.

W. S. pointed out that American foresters have before them an opportunity to be the pioneers in organizing the first unit of a nation-wide technical and professional federation. The significance of his suggestion is almost impossible to exaggerate. If we act on it, we will render a great service to the nation and to ourselves. If we do not, some other professional organization probably will. But, until somebody acts and until the proposed federation becomes a power in our national life, the technical worker will continue to be mere grist between the upper millstone of capitalism and the nether millstone of union labor. And, as some of us are beginning to realize, they grind exceedingly fine.

ALDO LEOPOLD.

NOTES

The Pulp and Paper Industry of Canada

Growth in the pulp and paper industry of Canada is shown by comparing the statistics of 1915, as given in the Census of Industry for that year, with the production in 1917, as presented in a report in the compilation of which the Dominion Forestry Branch, the Department of Crown Lands of Nova Scotia, the Department of Lands and Mines of New Brunswick, the Department of Lands and Forests of Quebec, and the Department of Lands of British Columbia collaborated.

In 1915 the number of active mills was 80 and the value of production $40,348,000; in 1917, 83 mills, with a production of $96,340,327—an increase of nearly 140 per cent.

In 1915 the consumption of pulpwood was 1,405,836 cords, according to the returns of the Forestry Department, and in 1917 it was 2,104,334 cords, or an increase of nearly 50 per cent. The total cut of pulpwood was 2,355,550 cords in 1915 and 3,122,188 cords in 1917, exports of pulpwood having risen from 949,714 cords in 1915 to 1,017,854 cords in 1917.

The increase in land, buildings, and fixtures was $10,078,229, or a gain per cent of 13.53; in machinery and tools the increase amounted to $27,410,331, or 86.04 per cent; in materials on hand, stocks in process, etc., the increase was $10,648,149, or 61.1 per cent; and in cash, trading, and operating accounts, etc., the increase was $4,913,893, or 48 per cent. The increase in the total capital investment was $53,050,602, or 39.66 per cent.

Salary and wage payments rose from $10,464,399 in 1915 to $20,358,019 in 1917—an increase of $9,893,620, or 94.6 per cent. The average number of salaried employees in 1915 was 1,131; this number increased to 1,563 in 1917, or by 38.2 per cent. The average number of wage-earners also shows a remarkable increase, being 14,177 in 1915 and 21,400 in 1917, or an increase of 50.1 per cent.

The consumption of pulpwood in all mills making pulp, whether purchased or cut from own limits, was 2,104,334 cords, of the value of $18,817,483, in 1917, as compared with 1,764,912 cords, valued at $13,104,458, in 1916, and 1,405,836 cords, valued at $9,426,217, in 1915, or an increase of 688,498 cords, or nearly 49.7 per cent, in the two-year period. The average price per cord was $6.71 in 1915, $7.42 in 1916,

and \$8.94 in 1917—an increase of \$2.23 per cord, or nearly 33.2 per cent, in the two years.

The order of importance of the five provinces remained the same as in 1916, Quebec leading with 1,109,869 cords, or over half the total; Ontario second, with 735,691 cords, or over a third of the total; British Columbia third, with 134,814 cords; New Brunswick fourth, with 105,586 cords, and Nova Scotia last, with 18,374 cords. The quantity of pulpwood consumed in each province is an increase in every case, as is the average value per cord of wood.

Spruce continues to lead all classes of wood, being 79.7 per cent of the total in 1917, balsam fir and hemlock being next in order of importance. These three woods all show increases from 1916. Poplar and pine show decreases from the preceding year and tamarack and cedar are reported from British Columbia for the first time in several years.

Heart Rot in Western Yellow Pine

Upon logged-off lands of the Flathead Indian Reservation the decay in western yellow pine occurs largely in strips and patches. These areas were very noticeable on account of the large number of culled logs remaining after logging operations were completed. An investigation of the trees on eight different parts of the cut-over land was made. My results, taken from 223 trees, are listed below:

Sample area.	Soil depth.	Slope.	Exposure.	No. of trees.	Loss by decay.
		Per cent.			Per cent.
I.	Shallow, gravelly loam........	20	S. E.	23	14.2
II.	Shallow, sandy loam..........	10	N. W.	24	19.2
III.	Deep, loamy clay.............	5	E.	9	1.5
	Moderate, gravelly loam......	5–15	S. E.	35	4.8
IV.	Moderate, gravelly loam......	5–10	N. E.	32	1.9
	Shallow, gravelly loam.......	5–10	N. E.	13	24.3
V.	Moderate, loamy clay........	5–10	N.	37	14.8
VI.	Shallow, loamy clay.........	5–10	E.	10	13.8
VII.	Moderate, loamy clay........	5–10	E.	11	2.
VIII.	Moderate, loamy clay........	5–10	E.	29	8.1

Shallow = to 1 foot depth, with some outcrop of rock.

There was very little external evidence of decay in the standing trees. Very frequently those in the worst stages had thrifty crowns and apparently perfect boles. Neither was decay restricted to large mature timber. Trees as small as 16 inches d. b. h. were frequently as badly affected as were trees of 40 inches d. b. h. The heaviest defect

occurred in trees between 20 and 30 inches d. b. h. The average d. b. h. of the stand was about 24 inches. Practically all trees were mature. The average rate of growth of trees examined on sample area No. V was one inch in diameter in seven to nine years until the last fifty years, when the rate of diameter growth dropped to one inch in twenty-five years.

Evidence of decay differed in trees. In some cases it was evident in the top only; in others in the stump only. Of the 52 trees affected the following figures show the location of the decay and its importance economically by the percentage of logs:

No. trees.	Evidence of heart rot in—			Total scale, board feet.	Loss due to heart rot.	Loss of total scale.
	Stump.	Main trunk.	Top.			
					Per cent.	Per cent.
7	7	..	..	8,240	2	.002
3	..	..	3	2,490	1	.0003
1	..	1	..	410	53	.0003
3	3	3	3	2,330	100	.03
24	..	24	24	43,840	30	18.1
14	14	14	..	15,150	58	12.1
52	24	42	30	72,460		

This little table seems to indicate that soil depth is indirectly the cause of heart rot, the fungus gaining entrance through mechanical injury in the top and working downward. Fire scars and other injuries to the lower portion of the trunk seldom resulted in material damage to the tree. JAMES B. SAXTON.

NEW JERSEY "SCRUB-OAK" RESPONDS TO CARE

For several years State Forester Alfred Gaskill has been urging owners of woodland to give their timber a little care and attention, in order that its value and productiveness might be increased. It has been the practice in this State and elsewhere to cut off the woods without care or thought of the future, and then allow Nature to do the best she can in replacing the abused timber growth. The following results of a "thinning" experiment in the so-called "scrub-oaks" of Burlington County prove that such attention is profitable.

In February, 1912, a portion of the Lebanon State Forest, six miles southeast of Pemberton, N. J., was selected for the demonstration. The tract, consisting of a rather dense stand of young oaks from ten to twenty feet tall, growing on sandy soil of low fertility, was purchased in December, 1909, for $6 per acre. Such stands are common through-

out south Jersey and are usually referred to as "scrub-oak" because of their generally poor condition. Much of such growth, however, consists of good species of oak, such as white oak, red oak, post-oak, chestnut-oak, etc., and the run-down condition is due to neglect, abuse, and repeated fires.

Two similar plots of approximately one acre each were laid out and the trees on each counted and measured. Then Plot No. 1 was "thinned" to relieve its overcrowded condition, just as garden vegetables are thinned so as to produce the largest and best crop possible. Enough crowded, weakened, and suppressed trees of the poorest species were removed to give the remaining trees the proper amount of light and growing space for their best development. Plot No. 2, to serve as a check or control, was not thinned.

In February, 1912, Plot No. 1, originally contained 607 trees from 2 to 7 inches in diameter breast high (4½ feet from the ground). In the thinning, 223 trees were removed, leaving 384 trees to grow. The original volume of Plot No. 1 was 5.46 cords per acre; 1 cord was removed by thinning, costing $1.50 in labor and yielding $1.25 from the sale of the wood, and 4.46 cords per acre were left to grow. Plot No. 2, the check plot, consisted of 555 trees, with a volume of 7.72 cords per acre.

Seven years later, or in June, 1919, neither tract having had any attention except protection from fire, the plots were again measured and the following results were noted: Plot No. 1 (thinned plot) had 380 living trees, the volume of which was 10.03 cords per acre, or an increase of 5.57 cords, not counting the one cord removed by thinning. Plot No. 2 contained 558 living trees, with a total volume of 8.63 cords, or an increase of less than a cord (.91 cord) for seven years' growth. In other words, the thinned plot almost doubled its wood volume in seven years, while the adjoining unthinned plot in the same time increased less than 9 per cent. Forestry pays!

The record in this study is made in cords because the trees are still too small to count for lumber. The next measurement should show that some trees have passed from the cordwood class to the railroad-tie class, and then on to sawlogs. New Jersey's forests must, and will, provide lumber; we have too much firewood.

Many a New Jersey farmer and woodland owner can increase the productiveness and value of his woodlands by applying similar forestry methods to his own property. No matter whether the woodland consists of young growth or older trees, a larger and more valuable crop of better quality—whether it be cordwood, ties, posts, poles, or lum-

ber—can be produced in a shorter time if the tract is treated so as to remove crowding and inferior trees, leaving just enough of the best trees to fully stock the stand. The work can be done so as to utilize idle labor in the slack winter season and at little or no expense. In fact, at the present demand and prices of wood products, such a thinning and cleaning will usually yield considerable profit of itself, in addition to the gain in the final crop. If an owner is not able to give his entire tract such an improvement cutting, he can accomplish the same thing gradually while cutting his supply of cordwood. The State Forester is ready to help any one interested in such a project.

The Osborne Fire-finder

The Osborne fire-finder, now in use by the Dominion Forestry Branch at Kamloops, was invented by W. B. Osborne, of the U. S. Forest Service at Portland, Oregon. It consists of a heavy circular metal base graduated near the outer edge. This base is supported below on four short metal legs, or points, which rest on two solid metal rods. The rods are screwed to a board and act as a track or guide upon which the points can slide back and forth. This sliding device is for the purpose of overcoming any near-by obstruction which may be in the line of sight, as, for instance, an upright or a window-frame in the lookout station itself.

Attached to the graduated circular base and lying flat upon it is a detachable circular disk of sheet metal. Mounted on the surface of this metal disk is the map of the country surrounding the lookout station. The map is so mounted that the position of the lookout station on the map is exactly in the center of the disk. The whole map and disk are covered with a transparent shellac, or varnish, to preserve it and prevent it becoming marked or weathered.

Fitting on top of the graduated base piece is a sliding metal ring of a slightly smaller diameter than the base and which may be turned through 360 degrees in either direction. To this sliding ring are attached two upright sighting pieces; also a handle, or grip, for the purpose of turning or sliding the ring. The sighting is done through a small slit, or a peep-hole, in the eyepiece upon a vertical horse-hair in the object-piece. A horizontal horse-hair is also stretched between the two sighting pieces. Stretched with edge up between the two uprights and just above the map is a flexible metal tape. It is graduated into inches and fractions of inches from the middle toward the ends, and by means of it the distance from the lookout station to any point on the

map may be read. Attached to the sliding ring, at the base of the upright eyepiece, is a vernier for the purpose of reading the angle through which the line of sight is turned.

The instrument also includes an attachment for the sketching of a panoramic profile of the surrounding country. A paper circle is laid over the map. Then, by following with the "point" the outline of the mountains and hills as they exist, their profile is automatically transferred to the paper. The thumb-screw imparts a horizontal movement to the pencil at the same time that it moves the point in a vertical one. The complete instrument weighs about fifty pounds.

Positions for Foresters

The Government of New Zealand desires to fill two positions, namely, a Director of Forestry, at £1,000 salary, and a Chief Inspector of Forestry, at £500. Both must be British subjects, graduates of a school of forestry of recognized standing, the former of not less than five years' and the latter of not less than two years' experience in forest management. First-class passage to the Dominion will be paid. Applications are to be made on special forms, obtainable from the High Commissioner for New Zealand, at 415 Strand, London W, C. 2., and are to be in by October 1, 1919; but this date will probably be extended.

From a reliable correspondent employed in the Forest Department of the Federated Malay States, we learn that the department contemplates increase in its technical staff, and wishes to locate good men, finding it difficult to do so in Great Britain. This country is new but very wealthy, especially in tin and rubber. The forest revenues collected last year amounted to over one million dollars. The Forest Department is headed by a Conservator of Forests, G. E. S. Cubitt, who comes from the Indian Forest Service and is highly praised by our correspondent. Some men acquainted with logging methods are especially needed. The superior staff of the department at present consists, besides the Conservator, of four Deputy Conservators, eight Assistant Conservators, and one Forest Research Officer.

The Lumbermen's Obligation to the South

The Federal or State governments must take title to the lands and assume supervision over reforestation work for the benefit of future generations. Private enterprise does not meet the requirements of this situation and can do little more than encourage Federal and State activities along these lines. To an appreciable extent, cut-over lands reforest

themselves, and such areas should be defined, protected, and exempted from all taxes until they may be incorporated in the National or State Forest Reserve.

The lumbermen are so conversant with this phase of our problem that extended remarks here would be without purpose. I only wish to suggest that all owners of cut-over lands may add to their value and attractiveness for future use, whether by themselves or other persons, if ten acres on each quarter section be fenced and reforested. The aggregate of such wood lots would be large enough to exert a favorable influence on the climate, provide shade, fuel, building material, etc. Such reforestation would in other ways contribute greatly to the value and desirability of the remaining lands for grazing or other purposes.—*Cut-Over Lands,* March, 1919.

Hardwood Log Situation Improving in Indiana

The log situation has greatly improved during the past few weeks, and many of the hardwood mills that were closed down a month or two ago are in operation again. It is expected, as the weather conditions in the South improve, more logs will be received by the hardwood mills. While the quality of logs received here is very good, the prices are unusually high—in fact, the highest ever known—and lumbermen are not expecting them to get any cheaper this year or next.

There are a few good lumber tracts left standing in southern Indiana, but the owners are holding them for fabulous prices and in many instances refuse to sell at all. Few Indiana logs have been received at the local mills for the past year. Maley and Wertz, hardwood lumber manufacturers of Evansville, bought up a few tracts of Indiana timber land last year, but most of these tracts have been worked up into logs. While the timber supply along Green and Barren rivers, in western Kentucky, has been greatly diminished during the past few years, there is still some timber standing in remote places, and a raft of logs is brought in from that section occasionally.—*Lumber,* May 5, 1919.

Lumber Problem in France

In 1914 France had 24,000,000 acres of timber and produced annually 6,700,000 cubic meters of lumber and 16,000,000 cubic meters of firewood. This was more firewood than France consumed and about half the lumber it needed. At that time France imported approximately 6,000,000 cubic meters of lumber, of the value of $34,000,000. Before

the war some 600,000 men were employed annually in building construction, and the annual expenditure for buildings was approximately $400,000,000. The Allied armies and the Germans consumed about 60,000,000 cubic meters of French lumber and 2,000,000 acres of timber land have been destroyed. Approximately, the number of houses entirely destroyed is 250,000 and the number of houses partly destroyed is 200,000. It is estimated that reconstruction will take ten years and will give employment to some 300,000 men. The cost of reconstruction will probably be some $4,000,000,000. Germany is expected to pay part of her indemnity in lumber, at the rate of 3,000,000 cubic meters a year for several years. The immediate consumption of France is estimated at 10,000,000 cubic meters for reconstruction purposes and 2,000,000 cubic meters for railroads.—*Lumber*, May 5, 1919.

Demise of Industrial Board Marks End of Price-stabilizing Program

The failure of the Industrial Board may be attributed as much to the attitude of business men toward its efforts as to the Attorney-General's ruling. It was doomed to disaster even if the law had not been in the way. The position of the lumbermen alone was sufficient to cripple it. Lumber ranks second among the "basic materials" which the board sought to control. Without an agreement as to lumber prices, other agreements were scarcely worth while. The lumbermen put the first stumbling block in the way of the board. It seemed to be easy sailing with steel, but the lumber interests refused to be forced or cajoled into an agreement. Their attitude put heart and courage into other business, and mighty little was accomplished beyond the announcement that certain moderate reductions in steel prices had been effected. Then Director-General Hines, of the Railroad Administration, put the finishing touches on the whole negotiations by refusing to agree even to the steel schedule. After that it was a play for time on the part of the board, with the hope that the President would come to the rescue. He refused to espouse the cause of the Industrial Board and its doom was sealed.—*The Southern Lumberman*, May 17, 1919.

Ontarioans May Create Forest Reserves

An interesting act has been passed by the Ontario Government in connection with the promotion of forestry practice in the province. It is provided by the act that the lieutenant-governor in council may declare any suitable land to be a "private forest reserve." The only things

necessary are the recommendation of the minister of lands, forests, and mines and the consent of the owner of the land. By the term "private forest reserve" is meant that the land so called is to be taken under the protection of the law. The man who thus declares his land to be a "private forest reserve" cannot remove a tree thereafter without appealing to the minister. Furthermore, any successor to the property is restricted in the same way. In short, the act means that once a piece of land is declared a "private forest reserve" it is to be always a reserve. Land need not be wooded to come under this act. The government is willing to provide the trees it is called upon to protect.—*American Lumberman*, May 17, 1919.

Hardwood Stocks Short

The Secretary of the Michigan Hardwood Manufacturers' Association stated at a meeting of the association May 5, 1919: "So far as we can learn, the hardwood stocks of the entire country are not sufficient to supply a pre-war manufacturing business. For various reasons, the log input of the past season has been very much below normal, and on this account values have advanced and will no doubt continue to do so as long as the cost of production is on its present basis."

"Mr. Jones is now in Europe placing the merits of the woods of Michigan and Wisconsin before the people of western Europe. There is no question but what this service is for the betterment of the position of our hardwoods."—*Lumber*, May 5, 1919.

Call Northwest Big Spruce Market

About thirty spruce manufacturers attended a meeting held at Portland, Oregon, May 9, for the purpose of discussing market conditions, grades, and trade prospects, as well as the log situation. The consensus at the meeting was that the demand for spruce is rapidly increasing, and that the Pacific Northwest is the only large source of supply, as other sections where spruce is being cut have turned their attention to the manufacture of pulp rather than lumber. It was pointed out that the eastern wholesalers are going out there to buy in larger numbers every month, and that the real problem confronting the industry is a possible shortage of logs.—*American Lumberman*, May 17, 1919.

During the year ending October 31, 1918, the Ontario Government derived a forest revenue of $1,756,085 from its Crown lands. Of this,

nearly half was derived from timber dues and approximately $190,000 from the fire tax of one cent per acre per year for lands under license. The total revenue for the year is the largest since 1912-1913, when the revenues closely approximated $2,000,000. The area under license at the close of the fiscal year is reported at 16,888 square miles, or 574 square miles greater than for the previous year.

The permit system for regulating settlers' clearing fires is working out well in practice. During 1918 9,590 permits for the burning of slash by settlers were issued, as against 3,486 for the previous season. According to the report of the Forest Service, the acreage covered by these permits amounted in 1918 to 39,683, as against 15,186 acres for the previous season. The permits are issued by members of the fire-ranging staff, and the Provincial Forester reports that, generally speaking, the settlers co-operate heartily and appear to appreciate the wisdom of the new regulations.

The maximum number of rangers and supervising officers was 1,190.

The forests of Cyprus are now in a fair way again to be a source of prosperity to the island. In 1879, the year after British control was established, an ordinance for the delimitation and preservation of the forests was passed. At first protection was the only means at hand, due to the small annual amounts at the disposal of the forest officers, but since 1907 special tree-planting has progressed, 300 miles of fire traces have been made, and goats will gradually be excluded by the enforcement of legislation passed in 1913 on the principle of local option for each village. Police protection has for the most part been good. The forests now extend to over 700 square miles. The principal trees are Aleppo pine and *Quercus alnifolia*, used in the manufacture of native plows and carts. Arbutus is found on the slopes of the hills and is used for rough furniture. It has been observed that of late years rainfall seems to have increased.—*Quarterly Review*, International Review of the Science and Practice of Agriculture.

Members of the Government service in this country will be interested in the remark quoted by a writer in the *Revue des Eaux et Forêts* for April, 1919, that "every able-bodied man who has spent more than five consecutive years in the public service ought to be immediately returned to active life. This is the only way to do away with the bureaucratic oligarchy that is now consuming the country." The writer remarks

that while the remedy may appear radical, this would not seem to alter the fact that it is a good time to return to industry, commerce, and agriculture many of the vigorous fellows whose muscles and brains are now becoming atrophied in the various bureaus. He points out that the war has proved that women can be advantageously utilized in many occupations, and suggests that the office force of the inspectors and district foresters ought to be reduced to not more than two male employees.

E. I. Terry has accepted the position as forest manager of the Battell Forest, a tract of about 30,000 acres of forest land in the Green Mountains belonging to Middlebury College. It was bequeathed to the college by Joseph Battell, who died in 1915, an alumnus and for many years a trustee of the college and one of Vermont's most public-spirited citizens. Mr. Battell spent nearly forty years in acquiring this mountain land, most of which is covered with virgin forest and is said by good authorities to constitute the finest tract of timber still existing in the State. It is the intention of the college authorities, and in accordance with the will of the donor, to preserve and gradually regulate this forest property so that it will become a permanently productive endowment to the institution.

A course for forest rangers was established at the University of British Columbia, under the charge of the Department of Soldiers' Civil Re-establishment. The course covered a period of five months, commencing in November, 1918. Mr. E. J. Hanzlik, Forest Examiner for the U. S. Forest Service, was director and taught the forestry subjects; Mr. A. Lighthall, a British Columbia civil engineer, taught mathematics and forest surveying, while Dr. A. H. Hutchinson, of the university faculty, and Dr. J. Davidson, provincial botanist, took forest botany. In addition, special lectures were given on forestry and allied subjects by men particularly fitted for the subjects assigned to them. The last part of the course consisted of actual work in the woods. The class comprised 21 students.

At the Wind River Nursery experiments have been concluded on the best season of sowing noble fir (*Abies nobilis*) and silver fir (*Abies grandis*). In common with what is commonly true of other species of seed which germinate rather slowly, fall sowing has been found best. Results of the experiment show that the best-developed and hardiest

plants are produced by fall sowing. Higher germination was secured from sowing at that period with both species and by far the best-developed plants. The plants were larger, more sturdy, and had a well-developed branching root system. The seedlings from fall-sown seed also matured their buds earlier and accordingly were in a better condition to withstand injury from frost than seedlings from spring-sown seed.

The legislature of Quebec has appropriated $100,000 for the provincial forest service and the inspection of lands for the fiscal year ending June 30, 1920; also $7,000 for the maintenance of the provincial forest nursery at Berthierville. These amounts are very materially supplemented by the expenditures on forest-fire protection incurred by the Ottawa River, St. Maurice, Laurentian, and Southern St. Lawrence forest protective associations, which patrol the great bulk of the licensed and privately owned timber lands in the province. The expenditures of these four associations on fire protection during the past year total $177,729.

Experience in Switzerland with the use of wood in coal-burning locomotives has proved that this can be done without any changes, provided that some coal be mixed with the wood to fill interstices. But it takes two firemen to keep up speed for passenger trains; and then, while coal-fed locomotives make 400 to 500 kilometers, on wood they can make only 60 to 100 kilometers with the amount the tenders can carry, 7 to 12 steres (1 stere equals about 35.3 cubic feet); hence only slow trains can be run on wood.

Lieutenant Edward M. Buol, Company C, 116th Engineers, A. E. F., writes that he will return to his former position, Professor of Logging Engineering in the School of Forestry of the Oregon State College, at the opening of the college year this fall. Lieutenant Buol went to France with the 20th Engineers as a private. He attended an officers' school in France and was commissioned as a second lieutenant. By peculiar chance he was sworn in as a commissioned officer by one of his former students, Lieutenant Haseltine.

During the past year the forest revenues of the Province of New Brunswick from Crown lands reached the highest figure in the history of the province, with the exception of the years 1913 and 1914, when

there were very heavy revenues in the form of bonuses, consequent upon the renewal of timber licenses. The forest revenues for the year ended October 31, 1918, aggregate $582,533. This figure includes $30,555 from the fire-protection tax. The aggregate of forest revenues during the preceding year was $443,848. These figures show the extent to which the Provincial Government is dependent upon its revenues from Crown timber lands to meet the expenses of administration of the government.

The court of governors of the University College of North Wales lately appointed a deputation to wait upon the Board of Agriculture regarding the proposal to have only two schools of forestry in Great Britain—one in Scotland and the other either at Oxford or Cambridge. Fears were expressed that if this was carried into effect it would mean the extinction of the forestry department in connection with the University College of North Wales. It was felt that one of the two new schools should be established in Wales, with its large area of forests.—*Science,* May 30, 1919, p. 516.

At the last session of the New Zealand Parliament £200,000 was voted for forestry, and already £2,000,000 have been sunk in the 32,645 acres of plantations of exotics. This great advance is due largely to the influence of Sir James Wilson and of Sir Francis Bell, leader of the legislative council, who now occupies the position of Minister of Forests. Mr. D. E. Hutchins rejoices that the "kauri, the largest and in many respects the most valuable timber-yielding tree of the world, is no longer doomed to extinction."

Harold S. Newins, for more than a year connected with the Aircraft Production Division, with headquarters in New York, will take up his former work as Professor of Forestry in the Oregon State College this fall. Professor Newins has been inspector of dry kilns for the aircraft division and has covered a territory extending from Massachusetts to North Carolina. The Oregon School of Forestry is congratulating itself on getting Newins back into the teaching game.

Apropos of the recent announcement that the Norwegian Forestry Society plans to provide nursery stock and replant 250 hectares of forest destroyed in northern France, the Germans remark that this will

be a large-scale example of the folly of using planting stock (especially of pine and spruce) of unsuitable origin. (Deutsche Forstzeitung, January 26, 1919, p. 50). How about white pine from the eastern United States?

George R. Green has resumed his duties as Associate Professor of Forestry at Pennsylvania State College. Professor Green was employed during the war as wood technologist at the Naval Aircraft Factory in Philadelphia, in charge of all experiments having to do with wood, glues, and fabric, supervision of the dry kilns, and the school for inspectors and wood workers.

The capacity of the Quebec forest-tree nursery at Berthierville is to be increased to an annual production of five million young trees, partly in anticipation that the Provincial Government will adopt a program of forest planting on denuded Crown timber lands.

Dr. B. E. Fernow has retired from the deanship of the Faculty of Forestry, University of Toronto, and has been made Professor Emeritus. He has recently also been made an honorary member of the Swedish Forestry Association.

Dr. J. S. Bates, Superintendent of the Forest Products Laboratories, Montreal, has resigned. He joins the staff of Price Bros. & Company, Quebec.

SOCIETY AFFAIRS

Committee for the Application of Forestry

The full membership of the committee is now as follows:

Gifford Pinchot, chairman; Donald Bruce, R. C. Bryant, B. P. Kirkland, P. S. Lovejoy, F. A. Silcox, J. W. Toumey, G. W. Woodruff, F. E. Olmsted (*ex-officio*). Advisory members: Charles S. Barrett, Clyde L. King, Joseph H. Pratt, Herbert K. Smith.

The committee held a conference early in September in Philadelphia, at which a draft of a report was discussed. The committee expects to have the report in shape for publication in the November issue of the Journal.

Committee on Reclassification

The President has appointed the following members to co-operate with the Congressional Commission on Reclassification: Raphael Zon, chairman; O. C. Merrill, H. S. Betts, J. W. Nelson, Louis Murphy, I. W. Bailey, R. C. Bryant, and H. P. Baker.

Committee on Forest Taxation

Louis Murphy has been appointed chairman of a committee on taxation. The other two members have not yet been chosen.

Committee on Forest Insurance, Forest Laws, and Forest Leases

A special committee, consisting of W. N. Sparhawk, Prof. B. P. Kirkland, and Donald Bruce, has been appointed by President Olmsted to consider and submit recommendations on the subjects of forest insurance, forest laws, and forest leases. Mr. Sparhawk is chairman of the committee.

Record of War Service

The Executive Council calls on members to furnish a complete record of military and civil duties during the war for incorporation in the files of the Society. Statements should be sent to the Secretary.

New York Section of the Society of American Foresters

The Section met on July 29 to 31, with 17 members and 11 guests, at the Ranger School of the New York State College of Forestry, Dean Baker and Director Craig acting as hosts and C. R. Pettis as chairman. The main topic for discussion was suggested by a letter of President Olmsted, namely, the national forestry program of Colonel Graves.

Addresses were made by Hugh P. Baker, H. L. Churchill, B. E. Fernow, C. R. Pettis, E. F. McCarthy, A. B. Recknagel, R. S. Hosmer, and B. A. Chandler.

The following resolution was adopted unanimously:

It is the opinion of the New York Section of the Society of American Foresters, assembled at its summer meeting at Wanakena, N. Y., July 31, 1919, that from the standpoint of improvement of silvicultural conditions in New York State, especial consideration should be given to the following points in the formulation of any State or national forest policy:

1. The public is justified in requiring the private owner to leave his forest lands in a reasonably productive condition after lumbering.

2. As a first step in the maintenance of productivity of forest lands in New York State, adequate fire protection is vital and should be brought about through more effective co-operation between private owners, the State, and the Federal Government.

3. Since it is a sound economic principle that all lands, whether agricultural or forest, should be kept in productive condition, it is believed that forest lands in New York now stocked with useful species can be kept reasonably productive, at least for the present, by natural reproduction, provided adequate protection from fire, fungi, insects, and the like be maintained.

4. Inducement by the State and Federal Governments should be offered private owners to encourage the reforestation of their idle lands.

Moved: That the chair appoint a committee to consider what, if any, assistance should be given by the State or Federal Governments to the private timberland owners in maintaining the productivity of their lands, and that this committee report at the next meeting of the Section.

It was also moved: That the Secretary of the Section communicate to the Secretary of the parent Society its feeling that the President of the Society should not have expressed personal views in articles published over his official title, which may be construed as representing views of the Society as a whole.

Officers of the Sections of the Society of American Foresters

Washington Section

W. R. Mattoon, Chairman;

J. Alfred Mitchell, Secretary-Treasurer, Atlantic Building.

New York Section

C. R. Pettis, Chairman;

A. B. Recknagel, Secretary, Albany, N. Y. (P. O. Box 440).

St. Paul Section

W. T. Cox, Chairman;

J. P. Wentling, Secretary, University Farm, St. Paul, Minn.

Missoula Section

Elers Koch, Chairman;

Edgar F. White, Secretary, Forest Service, Missoula, Mont.

Denver Section

C. G. Bates, Chairman;

F. R. Johnson, Secretary-Treasurer, New Federal Building, Denver, Colo.

Southwestern Section

Paul G. Redington, Chairman;

Quincy Randles, Secretary, Forest Service, Albuquerque, N. Mex.

Intermountain Section

L. F. Kneipp, Chairman;

C. F. Korstian, Secretary, Ogden, Utah (Twenty-fourth Street and Lincoln Avenue).

California Section

Walter Mulford, Chairman;

R. F. Hammatt, Secretary, 114 Sansome Street, San Francisco, Calif.

Portland Section

F. H. Brundage, Chairman;

B. E. Hoffman, Secretary-Treasurer, Forest Service, Portland, Oregon.

Madison Section

—— ——, Chairman;

D. R. Brewster, Acting Secretary, F. P. L., Madison, Wis.

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JOURNAL OF FORESTRY

Vol. XVII NOVEMBER, 1919 No. 7

The Society is not responsible, as a body, for the facts and opinions advanced in the papers published by it.

A PLEA FOR ADJUSTMENT

By Ernest A. Sterling

The President of the Society of American Foresters in the May (1919) Journal of Forestry makes a "Plea for Assertion." The inspiration for this plea or the personal views as expressed are unimportant, compared with the question of whether the elective head of the Society is correctly setting forth the views of the profession as a whole. This assumed function of spokesman assumes still broader significance after observing the effect of another recent dissertation by the same author on the old-school theme of the wickedness and incompetence of the lumber industry.

Foresters are urged to assert themselves and are said to lack aggressiveness. This assumes to throw all foresters into one class. It is fortunate they are not. Very few have dropped back through lack of aggressiveness; only a minority are still thinking about an American forest practice of the kind seen in traveling through Central European forests.

American and Canadian foresters have faced an entirely new set of problems, predicated on well-known conditions. In the main, they have met these problems in an eminently sound and practical manner. Without attempting to accomplish the impossible, they have established the fundamentals and won a stable place for themselves and their profession. Periodic outbursts, because their progress may not have been as fast as desired nor all their doings ideal, are more likely to destroy confidence and cause dissension than to help toward the goal.

We are to aim at "the practice of forestry *in the woods*." There is no clue as to what this "practice of forestry" is to comprise, but the point is clearly made that it must be conducted on private land. If this "constructive program" is to be carried out "in the woods" and these "woods" are private property, it seems logical that the owners will have a mild interest in what is to be done and how. They will welcome foresters in their woods and pay the bill, to exactly the

extent that it can be made a business project, but the way of approach is clearly not that of direct attack on their motives or ability. No magic can be worked "in the woods," and it is only those outside who wear rose-tinted glasses. There will be more foresters in the woods if those outside adjust their ideas to active woods conditions.

We clearly need a comprehensive forest policy, and the professional millennium will be near if we can "agree among ourselves as to what should be done and how to do it." It's worth trying, and co-operation, as urged, is essential to the ends desired. But just what it is we must fight for and create is not so clear. What has happened that we must start something?

And what is it that we have been afraid of, and just what opposition now "cries for facts"? If it is opposition to mandatory political action, it is a case of fighting shadows, for there is no authority nor legislation for applying any such policy. If any one should, it would be a real fight which would set forestry back indefinitely. But why introduce such a pugnacious attitude into a situation which calls for harmony and co-operation? Mr. Graves, in outlining his ideas for a national forest policy, has touched on Government control of private cutting, but in a way which invites co-operation and encourages helpful discussion. The private timberland owners, whose holdings are represented as the key to the situation, are not up in arms and are not likely to be as long as sanity prevails.

The resentment, implied if not expressed, in the "Plea for Assertion" and other recent articles by Mr. Olmsted seems to be toward the failure of the private owners to keep their land productive. If Mr. Olmsted, or any other radical forest policy advocate, had his capital invested in timber in any given region, or was responsible as trustee for funds so invested, would he do any different than the owners he criticises? Or would he in the past have kept his lands producing forest crops at the cost of dissipating his capital or making it unproductive? The economics of the case do not respond to theory, as various "working plans" have fully proven, and those without financial interest in the forests find it easy to criticise those who own timber.

A plea for mental adjustment seems timely. Most foresters have achieved this, to their own benefit and to that of the profession. If it can be made universal, the attainment of the desired ends will be hastened. The technical question of research data, its compilation and use, is a detail. The big thing is to work together through co-ordination of the profession and co-operation with the industry. Intolerance and innuendo will never formulate policies nor bring about their application.

ALINEMENT CHARTS IN FOREST MENSURATION[1]

By Donald Bruce

Division of Forestry, University of California

It is only in comparatively recent years that the value of alinement charts in the graphic solution of such formulæ as are constantly used by engineers has been appreciated, and to the forester they are still practically unknown; yet forest mensuration in particular involves problems peculiarly adapted to their application. There are two reasons for this: First, it is common to find that relatively simple formulæ must be applied repeatedly to very large masses of data; and, second, the accuracy of the field measurements on which the computations are based is not of a high degree, so that the moderate precision obtained by a graphic solution is entirely consistent and acceptable.

An alinement chart is a graph in which three variables involved in a given equation are expressed in lengths on three axes, of which two at least are usually parallel straight lines, and which are so arranged that corresponding values of the variables are always in line with one another. To use such a graph a straight-edge is laid across the assigned values of the two independent variables, and at its intersection with the third axis the proper value of the dependent variable is found. The axes to which the independent variables are assigned may be called the initial and the remaining axis the final axis.

It will be seen that the alinement chart is peculiarly adapted to formulæ involving three variables. More than three can be provided for, as will later be explained; but if there are but two, one axis is reduced to a single point through which the determining straight line must pivot. Such cases are not commonly of interest or value, and it is where three variables appear that the advantage of the method over the more com-

[1] This paper has been submitted for critical examination to a number of mathematicians and foresters competent to verify the theory and to judge the usefulness of the method. Several of the critics express doubt as to the superiority of the charts in their usefulness over the common slide rule and the use of tables. It is pointed out that the charts may be serviceable where the range in values is not great, as in investigating growth of spruce and balsam for pulpwood. They overcome the chief objection to tables, namely, the strain on the eye after a few hours' use. They are accurate enough for all mensuration problems in forestry, in which, as a rule, the measurement itself is not very accurate. At least, the discussion is suggestive and may lead to practical application.—Editor.

mon graphic form is most evident. An equation of three variables can be expressed in rectangular co-ordinates only by a series of curves (like the harmonized curves of a volume table), while in the alinement form these curves are replaced by three lines all of which are usually straight.

In the following pages are presented six charts applying to certain of

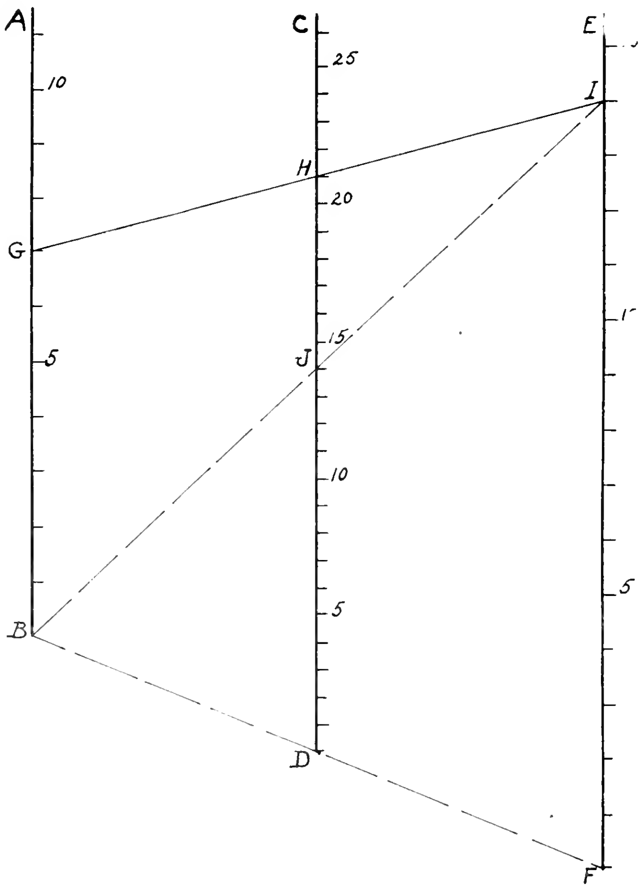

FIG. 1.—Elementary chart for addition.

the most commonly used formulæ of forest mensuration. In order to make clear how they have been prepared, it is first advisable to explain how such fundamental operations as addition, subtraction, multiplication, etc., may be handled. It should be understood that this explanation makes no pretense at completely developing the theory of alinement charts. As a matter of fact, it is restricted to two simple straight-line

types which, with their variations, singly or in combination, will be seen to be adequate for the solution of a very large number of problems. In fact, almost any equation can be handled by these two fundamental forms, but certain more complicated expressions give far better results if less simple types of graphs involving curved lines are used.

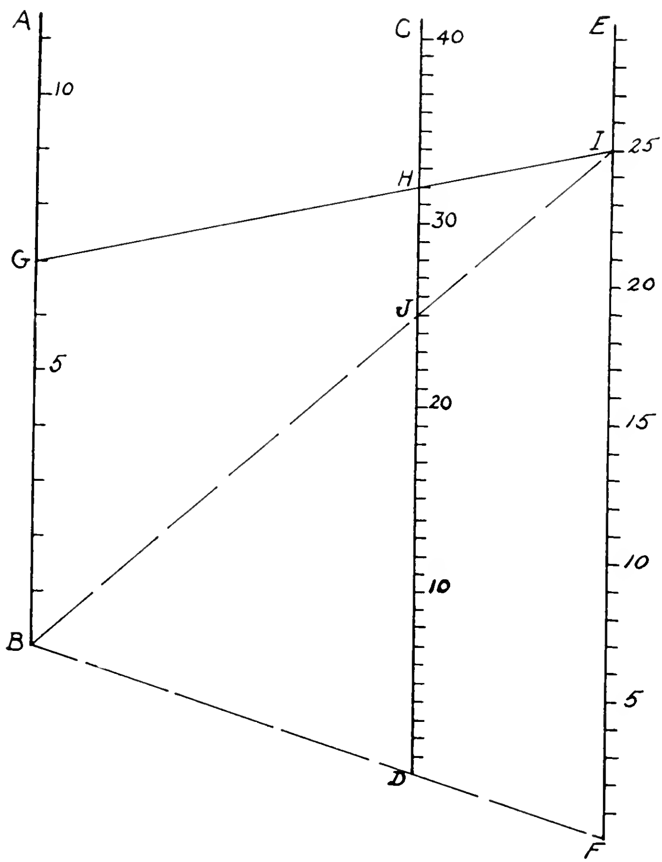

FIG. 2.—Elementary chart for addition, using different scales for the initial axes.

ADDITION OF VARIABLES

The fundamental chart form for such an addition as is expressed by an equation of the form $z = x + y$ consists of three parallel straight lines, the two outer lines being the initial axes, and the intermediate line, placed commonly half way between them, the final axis. Figure 1 illustrates such a graph. AB and EF are the initial axes of x and y,

respectively, and CD is the final axis on which z is measured. BDF is a straight line connecting the zero points of the three axes, and GHI a position of the straight-edge which connects corresponding values of x, y, and z. It is evident that since CD is equidistant from AB and EF, then if the straight line BJI is drawn, $HJ = \frac{1}{2}$ GB and $JD = \frac{1}{2}$ IF; therefore $HD = HJ + JD = \frac{1}{2}(GB + IF)$; or, if the scale with which values on CD are measured is one-half that used on AB and EF,

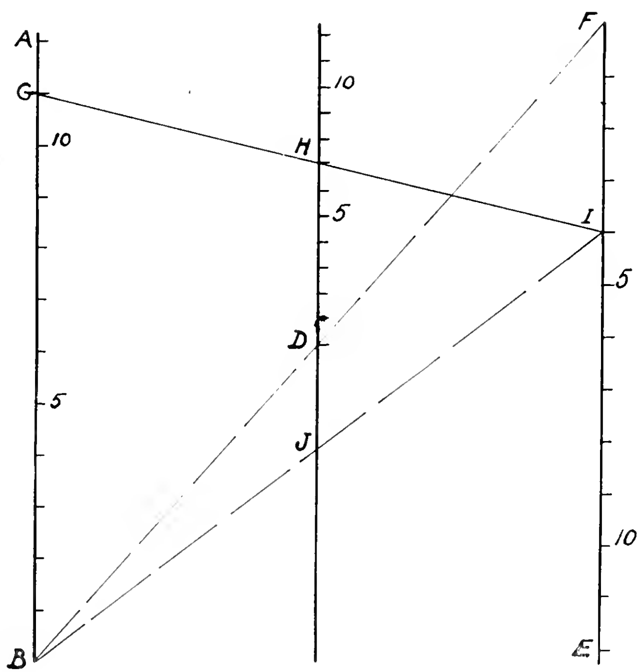

Fig. 3.—Elementary chart for subtraction.

HD will give values of z equal to $x + y$. Graduations so proportioned are shown on the figure.

It is often desirable to use two different scales for the two initial axes. This modifies the chart merely to the extent of shifting the position of the final axis. In figure 2 the scale on EF is only half that on AB. If CD is so placed that its distance from EF is one-half its distance from AB—that is, at one-third the distance from EF to AB—it will be seen that $HJ = \frac{1}{3}$ GB and $JD = \frac{2}{3}$ IF; therefore $HD = HJ + JD = \frac{1}{3} GB + \frac{2}{3} IF$. CD must therefore be graduated with a scale one-third that of GB to secure the same result as before.

In practice, in such cases it is not necessary to locate the position of the final axis or calculate its scale by analysis. It is often simpler first to locate its position by drawing two straight lines, each connecting a pair of values on the initial axes which gives the same result on the final, as, for instance, 2, 6 and 5, 3. Since $2+6=8$ and $5+3=8$, these must intersect on the 8 point on the final axis, which can then be

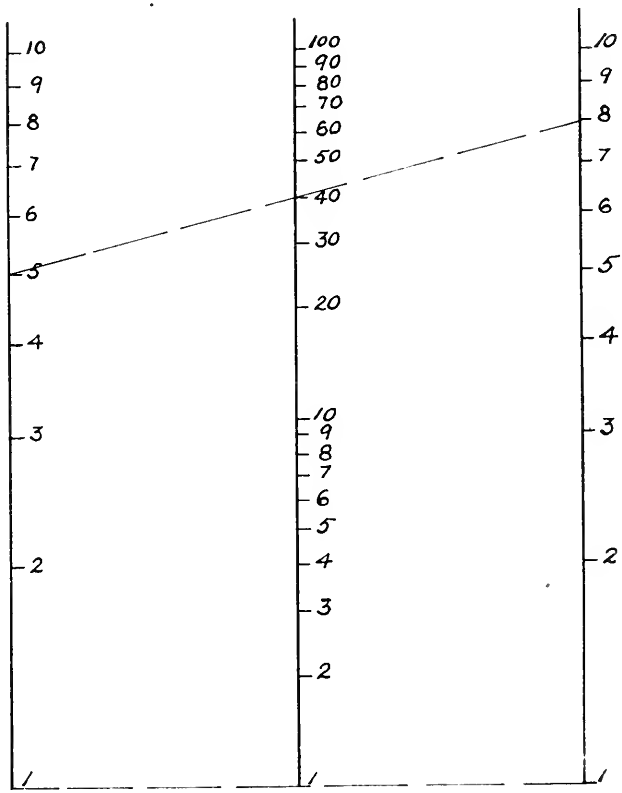

FIG. 4.—Elementary chart for multiplication.

drawn parallel to the other axes through that point. A third pair of values, such as 2, 5, will determine a straight line which intersects this axis at the 7 point, thus determining the graduating unit interval, which may then be applied to the remainder of the axis. Or the other graduations may all be supplied by intersections, taking some convenient value of x and varying successively the values of y and hence of z.

SUBTRACTION OF VARIABLES

The method of handling subtraction as represented by an equation of the form $z = x - y$ is merely a modification of that for addition. There are two variations. One method is to apply an addition chart in a reverse direction. In figure 1, for example, AB and CD may be considered the initial and EF the final axis. If CD is the x axis, AB the y, and EF the z, then obviously $x = y + z$, and therefore $z = x - y$.

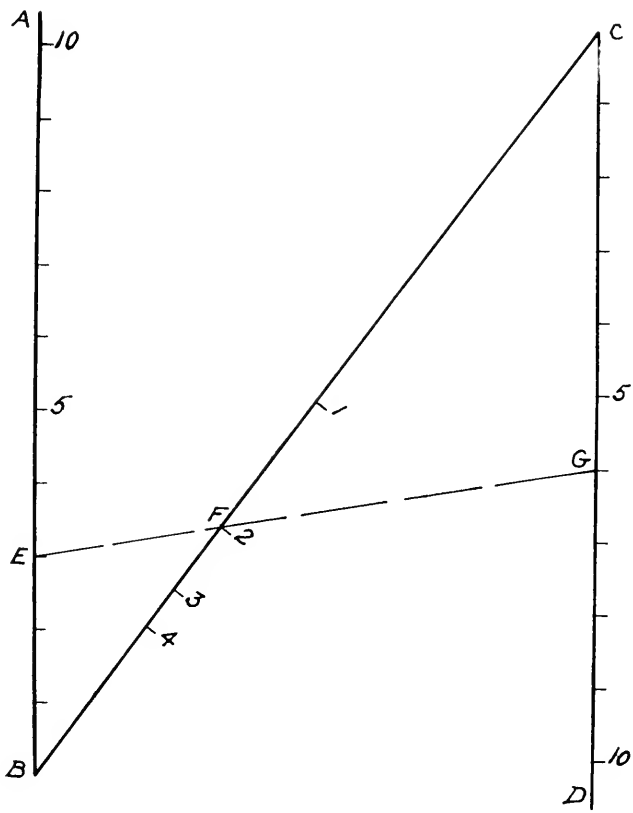

FIG. 5.—Elementary chart for multiplication.

The second method involves retaining the final axis in its intermediate position, as in the case first described, but graduating one of the initial axes negatively—that is, in a reverse direction. The principle here involved is the obvious one that $z = x - y$ may be written $z = x + (-y)$. The geometrical principle is indicated in figure 3, in which the letters are used in identically the same way as in figure 1, except

that the line EIF is inverted. Here it will be seen that, as in figure 1, HJ = ½ GB and DJ = ½ FI, but that now HD = HJ — DJ = ½ (GB — FI).

It is obvious that such a chart may be reversed to perform addition.

MULTIPLICATION OF VARIABLES

First Method.—The equation $z = xy$ may be written in logarithmic form: $log.\ z = log.\ x + log.\ y$. Multiplication can therefore be performed by means of a chart similar in form to that for addition, except that the axes are graduated to correspond with the logarithms of successive values of x, y, and z, instead of with the values themselves. Figure 4 is a simple graph of this type. Since the logarithms of 1, 2, 3, 4, etc., are 0.0000, 0.3010, 0.4771, 0.6021, etc., the graduations on the two initial axes are spaced at the latter number of units from the origin. The final or central axis is similarly graduated, but using a unit one-half as large. The broken line indicates the manner in which this chart solves the multiplication $5 \times 8 = 40$.

Second Method.—Multiplication can also be performed by what is known, on account of its shape, as a Z chart, in which logarithmic graduation is not necessary. Its principle is indicated by figure 5. In this AB and CD, 2 parallel straight lines, are the first initial and the final axes. These are graduated in opposite directions, B and C being the origins. BC is then the second initial axis. The broken line EFG represents a single position of the straight-edge, connecting related values. Since the triangles BEF and CGF are similar, their sides are proportional and

$$\frac{CG}{BE} = \frac{FB}{CF};$$

but

$$FB = CB - CF;$$

therefore

$$\frac{CG}{BE} = \frac{CF}{CB - CF},$$

which may be written

$$CG = BE\left(\frac{CF}{CB - CF}\right).$$

An equation of the form $z = xy$ can therefore be solved by a chart of this type, if

$$CG = z,$$
$$BE = x, \text{ and}$$
$$\frac{CF}{CB - CF} = y.$$

A series of uniform graduations is all that is needed on BA and CD, but the graduating of CB must be calculated from the last of the above equations.

In any given chart CB is an easily obtainable constant. Suppose, for example, that CB = 10 units, then we have

$$\frac{CF}{10 - CF} = y.$$

which reduces to $CF = \dfrac{10\,y}{1 + y}$.

It follows that if $y = 1$ $CF = 5$
$= 2$ $= 6.67 -$
$= 3$ $= 7 \cdot 5$
$= 4$ $= 8$, etc.

In practice it is often simpler to graduate this diagonal axis by intersecting it with a series of straight lines connecting values on the initial axes to correspond with the successive values of y. For example, the line connecting 2 on the AB scale and 2 on the CD scale must intersect CB at 1; 2 on the AB scale and 4 on the CD scale must intersect CB at 2; 2 on the AB scale and 6 on the CD scale at 3, etc. This method also eliminates the slight confusion which results from using different scales on AB and CD, as is often desirable.

DIVISION OF VARIABLES

The method of performing division is deduced from multiplication, just as subtraction from addition. In this case also there are two alternatives: (a) a multiplication chart can be used in a reverse direction, since $z = \frac{x}{y}$ can be written $x = yz$; or (b) we may substitute for division by a number, multiplication by its reciprocal, since $z = \frac{x}{y}$ may be written $z = x\left(\frac{1}{y}\right)$. Each of these alternatives is applicable to either form of multiplication chart.

VARIABLE EXPONENTS

Such an equation as $z = x^y$ may be written $log.\,z = y\,log.\,x$. In its latter form it can be readily charted as a multiplication. If the z-chart method is used, one vertical axis may be regularly graduated to express values of y; the other, or final, vertical to correspond with the logarithms of values of z, and the diagonal most simply by intersections.

CONSTANT TERMS, COEFFICIENTS, AND EXPONENTS

The simplest method of handling any constants which appear in a formula is to group them so far as possible with one of the variables and let them modify the graduations of the corresponding axis. For example, in such an equation as $z = \frac{1}{2} x^2 + y + 1$, all three constants—the term 1, the coefficient $\frac{1}{2}$, and the exponent 2—can be

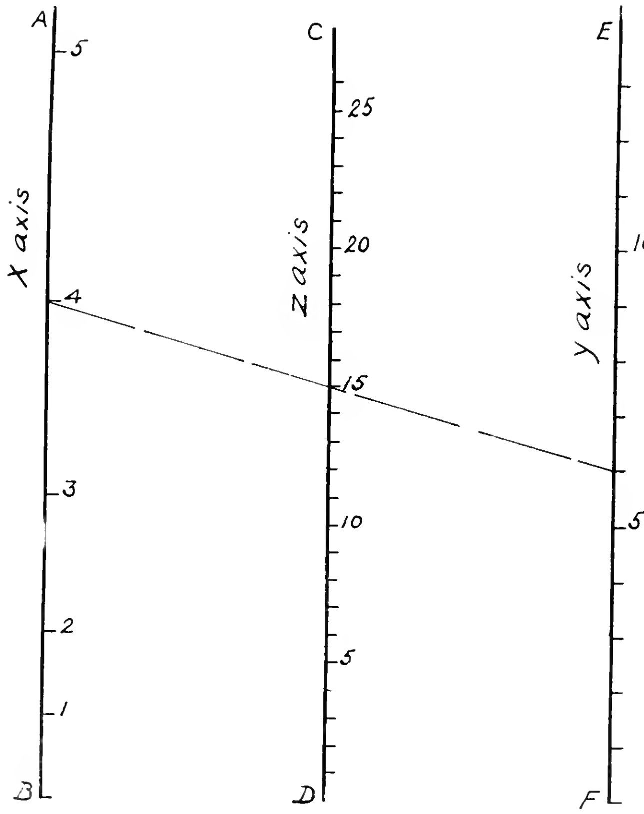

FIG. 6.—Chart for equation $z = \frac{1}{2} x^2 + y + 1$.

grouped with x by writing the equation $z = (\frac{1}{2} x^2 + 1) + y$. The solution then involves an addition chart similar to that of figure 1, with the exception that the x axis is now graduated for values of $(\frac{1}{2} x^2 + 1)$. In figure 6, for example, which is designed to solve this equation, the graduations of CD and EF are identical with the same axes in figure 1, but that of AB is determined as follows:

When $x = 1$ $\frac{1}{2}x^2 + 1 = 1.5$
$= 2$ $= 3$
$= 3$ $= 5.5$
$= 4$ $= 9$, etc.

The graduations 1, 2, 3, 4, etc., are then placed at 1.5, 3, 5.5, 9, etc., units from the origin.

COMBINATION OF OPERATIONS

Many formulæ involve the addition or multiplication of more than two variables or both an addition and a multiplication. Such cases are

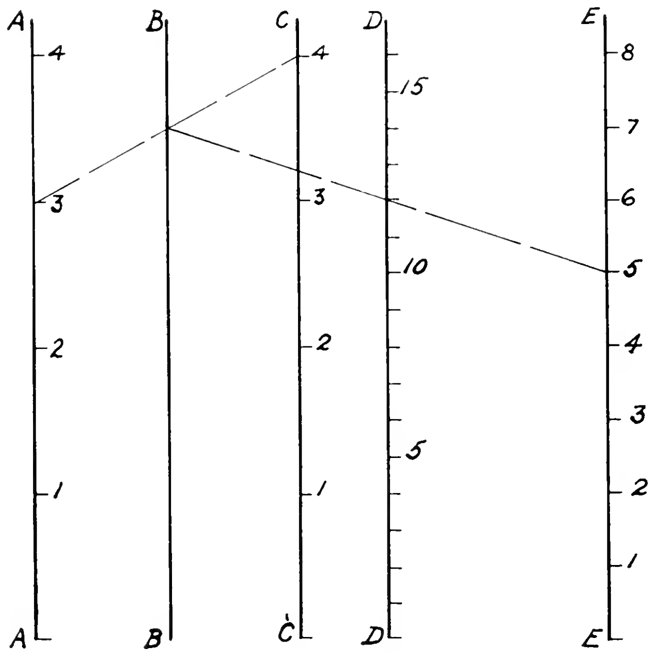

FIG. 7.—Elementary chart for addition of three terms.

simply provided for by constructing two systems of axes in which the final axis of the first system becomes one of the initial axes of the second. The method will be evident from a consideration of figure 7, designed to solve the equation $v = x + y + z$.

The first system consists of the lines A, B, and C, x being measured on A and y on C, so that the final axis B will measure the sum $x + y$. This B axis then becomes one of the initial axes of the BDE system. If

E, the second initial axis of this system, measures values of z, it is evident that D, the final axis, will measure the values of $x + y + z$, and therefore of v. In this chart, if A and C are graduated with the same unit, B will be equidistant from them and graduated with a scale one-half as great. As values of B are not recorded, the graduation of this axis may be omitted. E, however, must be graduated with the same reduced scale (one-half that of A and C) if D is to be equidistant from it and from B. Finally, the scale with which D is graduated must be one-half that of B and E or one-fourth that of A and C.

To use such a chart a straight-edge is laid across the values of x and y on A and C, and its intersection with B caught and held with a sharp-pointed pencil or a needle point. The straight-edge is then shifted to connect this point with the given value of z on E, and the resulting value of v read on D. The broken lines of figure 7 indicate the solution $3 + 4 + 5 = 12$.

It is often possible to simplify the appearance of such a chart by combining two axes into one with a double set of graduations. Examples of this will appear in the charts which follow.

SELECTION OF SCALES AND ARRANGEMENT OF AXES

In applying the simple principles which have been described, good judgment is required in choosing proper scales for graduating the axes. On the one hand the units must be large enough to permit readings to the required degree of accuracy, and on the other the whole chart must be kept within reasonable limits of size. Oftentimes both objects cannot be obtained on a single graph, and two charts, one for low and one for high values, must be employed. The two can usually be combined on a single set of axes by using a double set of graduations. The same expedient is often desirable on a z chart to avoid too acute intersections between the straight-edge and the diagonal axis in the case of small values. In choosing the positions of the axes the chief considerations are the avoidance of acute intersections and the securing of a compact chart of moderate size. All of these points will become clear through a consideration of the graphs which are described in subsequent pages.

MODIFICATION OF SCALES

In certain cases it is impossible to prepare by the methods already described a chart which does not have one or more of its scales badly congested in one part and unnecessarily expanded in another. Such a

condition can usually be avoided by substituting for the parallel axes lines that converge or diverge. Without attempting a rigorous proof,

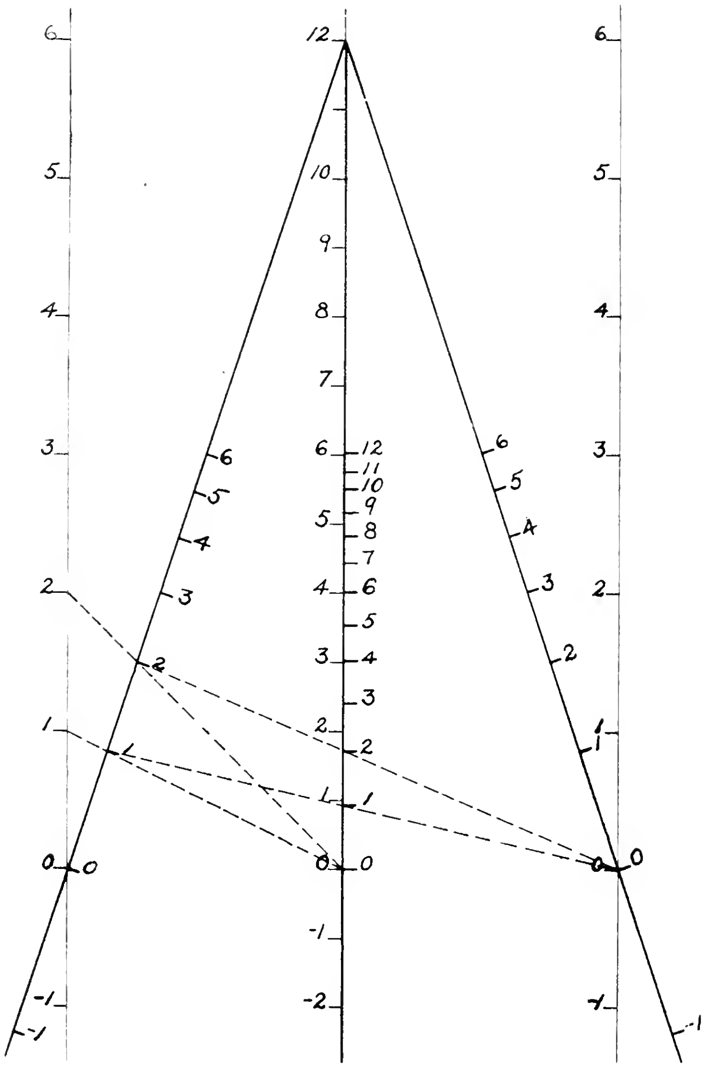

Fig. 8.

the effect of such a transformation can be understood from the following considerations. In an addition chart composed of three parallel axes, such as has already been described, these three axes may be con-

sidered to mutually intersect at an infinite distance. Now if this point of intersection be brought up to within a finite distance, all mutual interrelations may be maintained, but the graduations of the axes will obviously be distorted, since this point of intersection will now represent infinity on each scale.

Both the effect of such a transformation and the method of performing it are shown in figure 8. The three light parallel lines are the axes of the original addition chart which are to be replaced by the three intersecting heavy lines. The figures at the left of the axes refer to the original and those at the right to the transformed graph. The broken lines indicate the method of construction by which the new axes may be graduated. While in the present case the first set of these construction lines radiate from the zero point of the central axis, this is not an essential condition and any point on this axis might have been chosen, although with a difference in the resulting scale. It will be noted that in the present case the values above zero are condensed and those below are expanded. If the center of radiation of the construction lines had been located at the original 10 graduation on the central axis, the values above 2 would have been condensed and those below expanded. By varying the position of this center of radiation and of the point of intersection of the axes, it is evident that very considerable latitude in the graduations is obtainable. It should be remarked, however, that it is undesirable to attempt any material expansion of the vital portion of any scale by this plan, as all graphic inaccuracies are thereby magnified.

In practice the preferable procedure is to first construct the parallel-line form of graph, using a unit interval near the zero point which is satisfactory, even though this may make a chart of excessive size. The construction line from zero on the central axis to the maximum required value on the side axis may next be drawn. The intersection of this line and the desired upper boundary of the final graph will then fix the new position of the side axis. (It is, of course, not necessary that the point of intersection of the axes fall within the limits of the final graph.) If the higher graduations prove too condensed, the only alternatives are to increase the size of the chart or to reduce the interval adopted for the lower values.

It is evident that figure 8 illustrates the method employed rather than the advantages gained. Cases where the latter are prominent are such as the equations $z^2 = x^2 + y^2$, or $\tan z = \tan x + \tan y$, which obviously would be difficult or even impossible to plot for any considerable range on parallel axes.

In some cases the original chart becomes prohibitively large when this method is attempted, and it is necessary to find an algebraic expression by means of which the new axis can be graduated. Where the center of radiation of the construction lines is at the zero point of the central axis, as in figure 8, this is $u = \frac{cv}{c + y}$, where u is the vertical distance above the zero point of any graduation on the new axis, v the vertical distance above the zero point for the corresponding graduation on the old axis, and c the vertical distance above the zero point of the point of intersection of the axes. In figure 8, for example, if the original scale of the central axis be employed the graduations on the sloping axis may be found at $\frac{12v}{12 + v}$ units above the zero point. For the 6 graduation on the left-hand vertical axis, which is 12 units above the zero point, $v = 12$, and $\frac{12v}{12 + v} = 6$; it will be noted that this graduation on the inclined axes lies at this height above the base.

In such cases as are illustrated by the equation $\sqrt[3]{z} = \sqrt[3]{x} + \sqrt[3]{y}$ the graduations on the simple form of chart become rapidly too condensed. This condition can be remedied by placing the common point of intersection on the negative side. Here, since the graphic method involves the expansion of small intervals, and hence a serious source of error, as has been already noted, it is better to calculate the position of the graduations on the outer axis, after which the central scale can be prepared by intersections. The formula in this case is

$$u = \frac{cv}{c - v}.$$

In an entirely similar way one of the parallel lines of a z chart can be swung with its intersection with the diagonal as a pivot. The construction in this case is parallel to that just described, and the only material difference in the result is that while one of the scales is contracted in its useful portion, the other is expanded. This statement applies to the two axes which were originally parallel, the diagonal being entirely unaffected by the transformation. The same formula as in the previous case may be used for locating the graduations on the altered axes, if u is understood to represent the distance measured vertically above the diagonal axis.

Figure 9 illustrates a simple z chart thus altered. In this example the point of intersection is beyond the limits of the chart. Construction lines are indicated, as before, by broken lines.

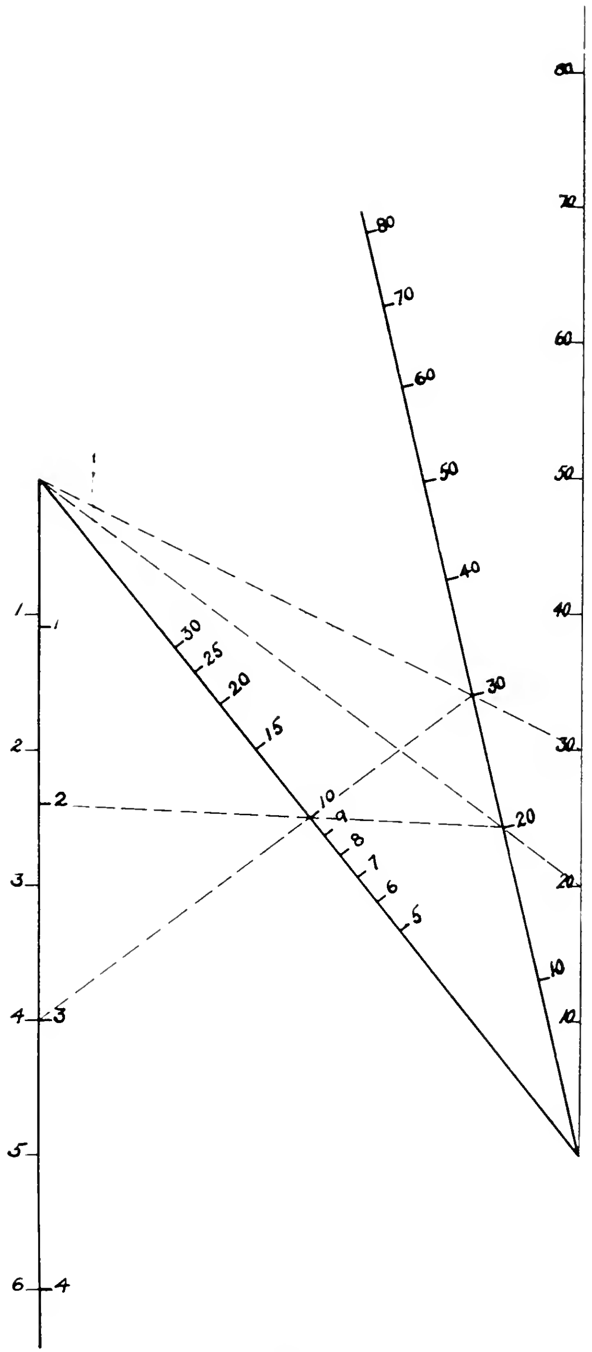
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Fig. 9.

HUBER FORMULA

The Huber formula for finding the volume of a log in cubic feet is commonly given $V = B^{1/2} L$, where V is the volume in cubic feet, $B^{1/2}$ the cross-section area at the middle in square feet, and L the length in

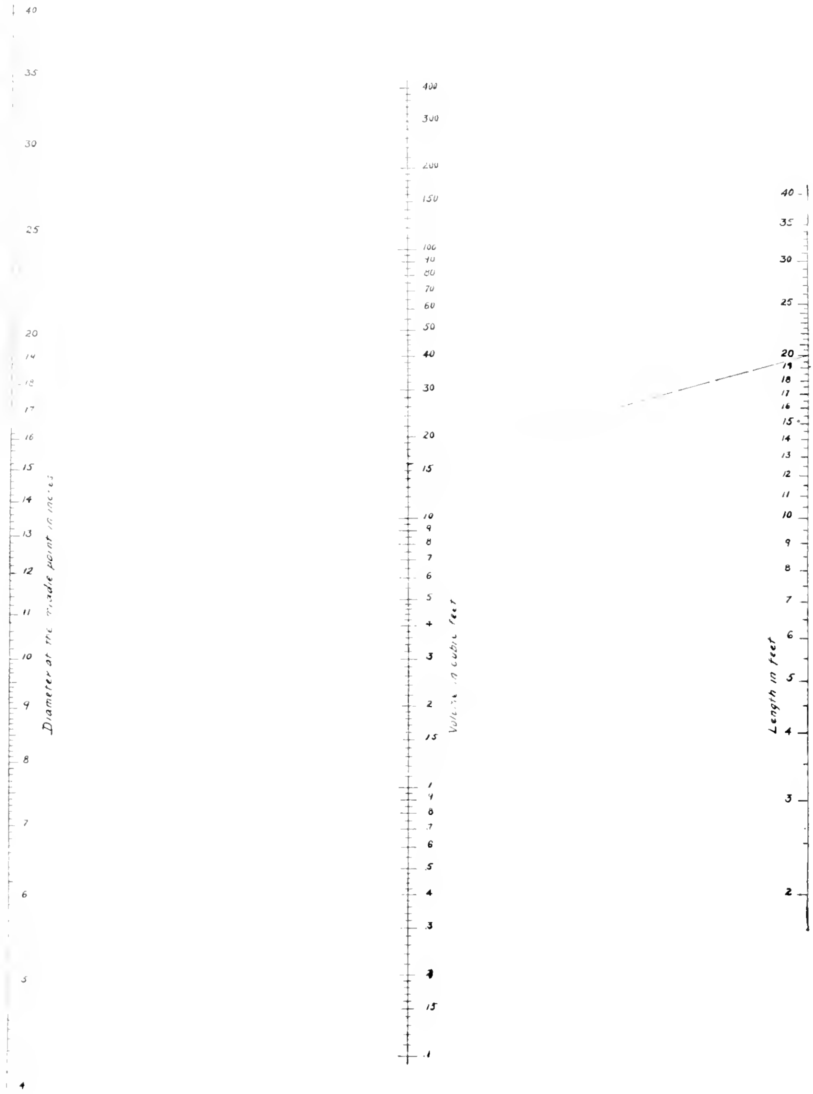


FIG. 10.—Graph for finding volumes of logs in cubic feet by Huber formula.

The broken line indicates that the volume of a log 20 feet long and 12 inches in diameter at the center is 15.7 cubic feet.

feet. The measurements actually taken are, however, L and $D^{1/2}$, the diameter in inches at the middle. The formula must therefore be written

$$V = \left(\frac{\pi D^{1/2\,2}}{4 \times 144}\right) L.$$

Figure 10 is a chart which graphically solves this equation. It involves merely the multiplication by L of the expression in the parenthesis involving D. The first form of multiplication chart has been adopted, since acute intersections are thereby avoided. The original axes are assigned to D and L and the intermediate terminal axis half way between them to V. The same graduations are used on both of the original axes, as this has been found by experiment to make them of approximately equal length when graduated to the desired range of values. The final axis is, therefore, equidistant from them and graduated with a unit one-half as great. The L axis is graduated with distances from the origin corresponding to the logarithms of consecutive digits from 4 to 40, and the V in a similar manner from 1/10 to 400. The D axis is graduated with distances corresponding to the logarithm of

$$\left(\frac{\pi D^2}{4 \times 144}\right).$$

No attention is given to the relative positions of the origins of the three scales, but the graduations of the outer axes are arranged in a convenient manner and the location of a single point on the intermediate axis is obtained by a single computation and the resulting intersection. The remainder of its graduations are then plotted from that as a starting point.

In graduating an axis such as the L axis, where the origin is not required, no attention is given to its location, although all graduating distances are measured from it. If the lowest value required is 2, as in the present case, a scale may be laid along the axis with the value corresponding to 2 opposite any convenient point and the remaining graduations located directly without shifting the scale.

FORM-FACTOR METHOD

The formula for obtaining the volume of a tree from its form factor may be written either:

$$V = FBH \text{ or}$$

$$V = F\left(\frac{\pi D^2}{4 \times 144}\right) H.$$

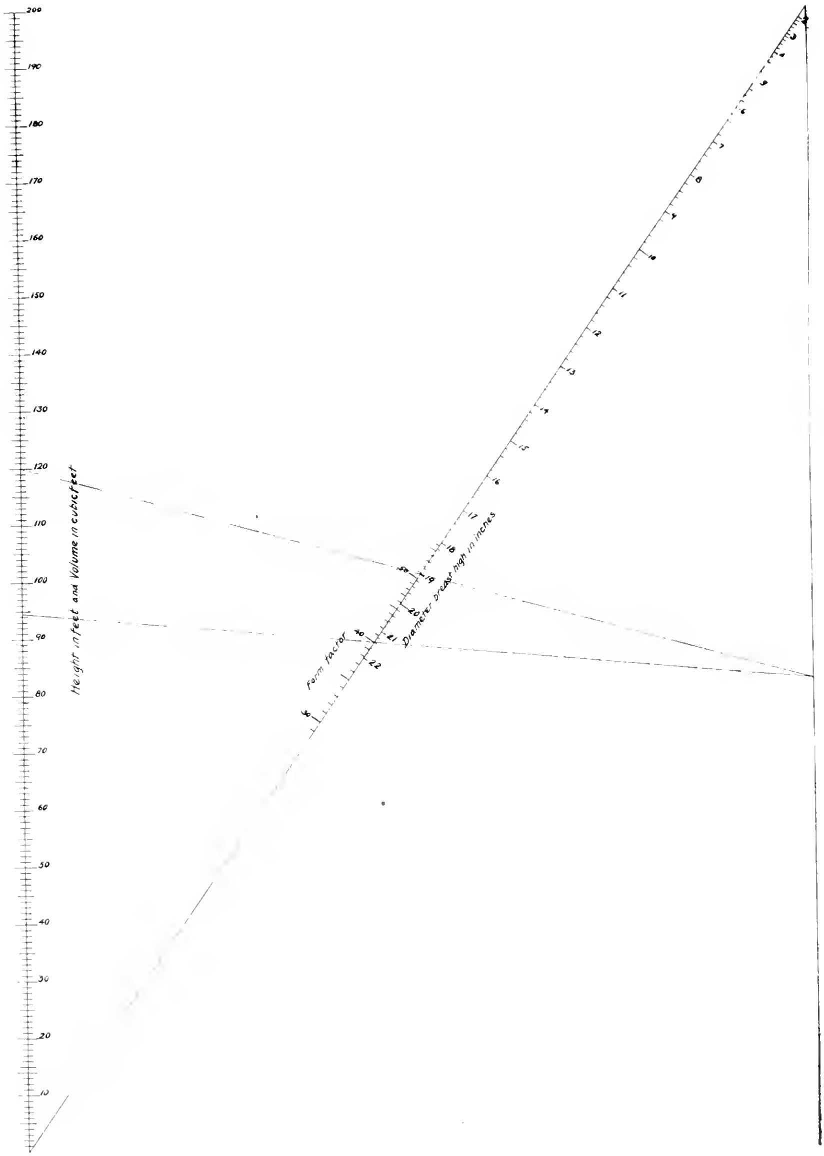


FIG. 11.—Graph for finding volumes of trees in cubic feet from d. b. h., height, and form factor.

The broken line indicates that the volume of a tree 19 inches in diameter and 120 feet high, having a form factor of .40, is 94.5 cubic feet.

where V is the volume in cubic feet, F the form factor, B the basal area in square feet, D the basal diameter in inches and H the height in feet. In this case it is necessary first to multiply $\left(\frac{\pi D^2}{4 \times 144}\right)$ by H and then multiply the product by F. This involves two systems of graphs, as has already been described. Figure 11 utilizes the z form of chart. For performing the first multiplication the left-hand vertical axis is assigned values of H, the diagonal values of D, and the right-hand vertical, while not graduated, measures the product of H and of the expression involving D. The second multiplication uses the same axes over again in the opposite direction. The diagonal has a second series of graduations assigned to values of F, and the left-hand vertical, which now becomes the final axis, is assigned values of V as well as of H. The last axis, however, uses exactly the same scale and graduations for both V and H.

At first sight it may seem a complex matter to so calculate the scales as to make this possible, but actually this is not the case. The starting point is the H axis, which is regularly graduated, using any convenient unit. It is obvious that the right-hand vertical axis, which is not graduated, must really express $\left(\frac{\pi D^2}{4 \times 144}\right)$ H, which expresses the volume in cubic feet of a cylinder of a height of H feet and a diameter of D inches. Temporary regular graduations are, therefore, placed upon it, using a scale found by trial to locate the D values on the diagonal in a convenient position. The D graduations are then located by intersection in the manner already described. Computations in connection with the location of the intersecting lines may be avoided by the use of a table of volumes of cylinders, such as is commonly used in forest mensuration. As the same graduations for V as for H are to be used, the F values may next be added to the diagonals, again using the method of intersections. Thus a given value on the right-hand axis is successively joined by straight lines to varying values of V, which by a simple and obvious calculation are found to require successive values of F.

THE SMALIAN FORMULA

The Smalian formula for finding the volume of a log in cubic feet may be written either

$$V = \frac{(B + b)}{2} L \text{ or}$$

$$V = \left(\frac{\pi D^2}{4 \times 144} \quad \frac{\pi d^2}{4 \times 144}\right) \frac{L}{2} = (D^2 + d^2) \frac{\pi}{1152} L,$$

where V is the volume in cubic feet, D the diameter at the large end in inches, d the diameter at the small end in inches, and L the length in

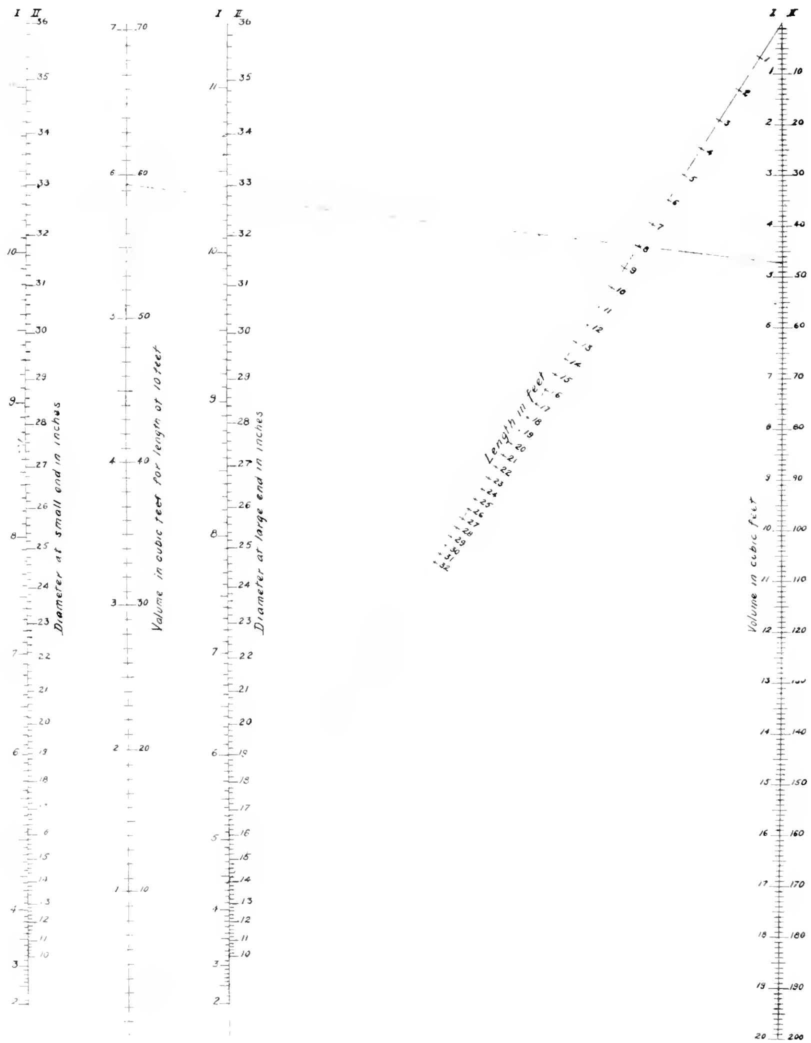


FIG. 12.—Graph for finding volumes of logs in cubic feet by Smalian formula.

The broken line indicates that the volume of a log 32 and 34 inches in diameter at its ends and 8 feet long is 47.3 cubic feet.

feet. The solution of this problem involves an addition, followed by a multiplication. Since the terminal axis of the addition is inevitably

graduated regularly rather than logarithmically, the z form of multiplication must be employed. Figure 12 is such a chart. The three vertical axes at the left form the addition system, the central, or terminal, axis of which is also the initial axis of the z system, which extends to the right.

The method by which the axes are graduated is as follows:

(*a*) The right-hand scales of the two diameter axes are first graduated, assigning to each successive value a number of units equal to its square—that is, 1 is placed at 1 unit from the origin, 2 at 4 units, 3 at 9, etc.

(*b*) The center axis of the three is drawn equidistant from the other two and need not be graduated. All that is required on this axis is a single known point easily obtained by an intersection, which will be used in graduating the diagonal.

(*c*) The right-hand side of the volume axis is next graduated regularly in any convenient unit.

(*d*) The diagonal is to be graduated in terms of $\frac{\pi L}{1152}$, but these values need not be calculated, as their position can be more easily obtained by a series of intersections from the known point described under (*b*). This process should be clear, from what has preceded.

(*e*) The chart is now complete, but for logs of small size annoyingly acute intersections with the diagonal result. A second scale is therefore added on the left-hand side of both the two D and the V scales, using a unit ten times as great as before. As the proportions remain unchanged, the same graduations on the diagonal or L axis will serve, providing that all readings in a single computation are made either entirely on the right or on the left-hand scales. The Roman numerals at the head of the scales are intended to reduce the chance of error in this respect.

(*f*) The standard length for cutting logs when prepared for measurements in cubic feet is ten feet. Since many more computations involving this length will be made than for any other, it is obviously advantageous to graduate the central axis of the first system to provide for the standard size. This can be done without disturbing the rest of the chart, for if $L = 10$, the formula becomes

$$V = (D^2 + d^2)\,\frac{\pi\, 10}{1152}.$$

Since $\frac{\pi\, 10}{1152}$ is a constant, it can be provided for in the graduating of

the terminal axis of the addition system. The scale unit necessary is easily found by locating two known points at a one-unit interval by intersections in the manner already described.

SCHIFFEL FORMULA

The Schiffel formula for finding the volume of whole trees in cubic feet may be written

$$V = (.16\,B + .66\,B^{1/2})\,H$$

or

$$V = \left(\frac{.16\pi D^2}{4 \times 144} + \frac{.66\pi D^{2\,1/2}}{4 \times 144}\right) H$$

$$= (.16\,D^2 + .66\,D^{2\,1/2})\,\frac{\pi H}{4 \times 144}$$

$$= (D^2 + 4.125\,D^{2\,1/2})\,\frac{\pi H}{3600},$$

where V is the volume in cubic feet, B the basal area breast high in square feet, $B^{1/2}$ the basal area in square feet at one-half the height, H the height in feet, and D and $D^{1/2}$ the diameters in inches at breast height and at one-half the height.

This formula is similar in form to the Smalian formula already described, and requires first an addition followed by a multiplication. The general design of figure 13 is similar to that of figure 12. In this case, however, since one of the diameter axes is graduated in terms of D^2 and the other in terms of $4.125\,D^2$, a different unit for the two original axes of the addition system is desirable. In figure 13 these two scales are in a ratio of 10 to 3. As a result, the terminal axis of this system is no longer evenly spaced between them, but is so located that its distances from the two are in a 10 to 3 ratio. The V axis at the right is graduated regularly with any convenient unit, but the diagonal H axis is graduated entirely by intersections, using one or more known points on the ungraduated final axis of the addition system, as has already been described. A second series of graduations at the left of the two D scales is next added, using a unit ten times as great. This results in a second series in similar proportion on the V axis. In this case, however, an additional complication seems desirable to permit lower readings of H, and a second H scale is added to the left-hand side of the diagonal, using a unit ten times as great. This necessitates a third scale on the V axis, using a unit again multiplied by ten. To prevent confusion, the scales on the left-hand vertical axis are designated I and II, respectively, and those on the diagonal A and B, respectively. The largest numbers on the V scale are then headed IIB,

since they are to be used only when values of the II scale and of the B scale have been used in conjunction. The smallest values on this V axis are headed IA, since they are for use when the I and A scales have been

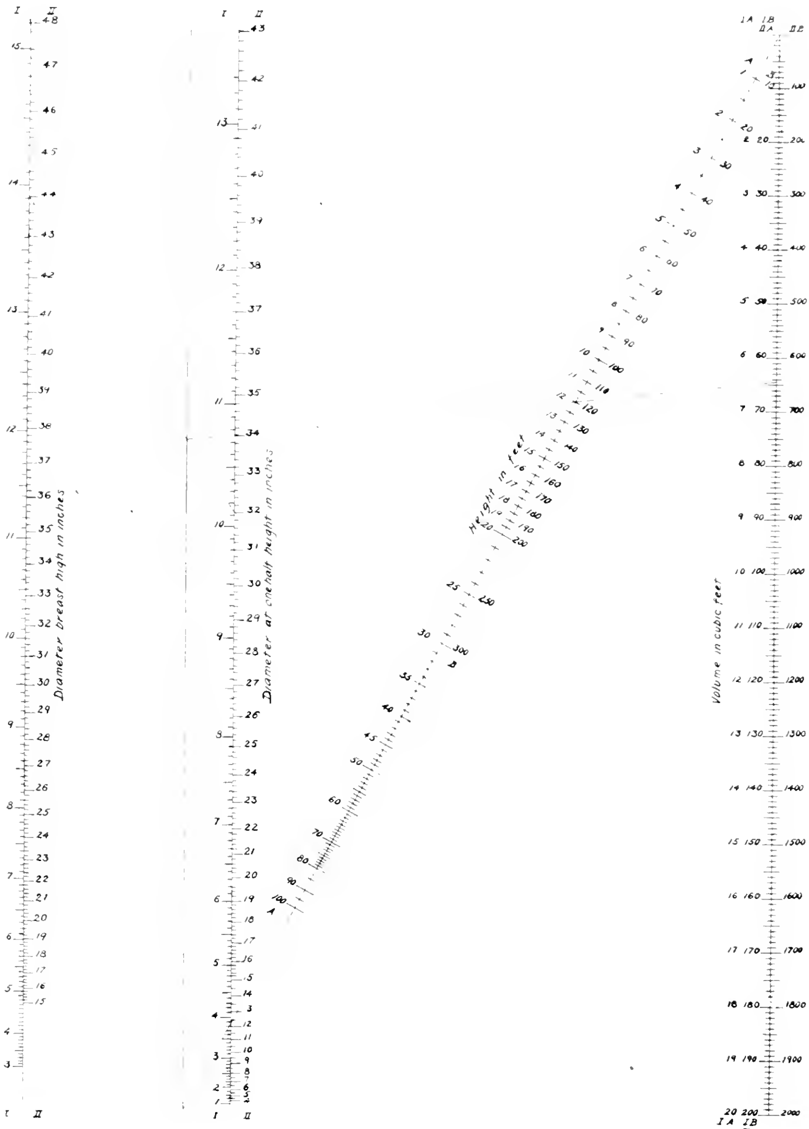


FIG. 13. -Graph for finding volumes of trees in cubic feet by Schiffel formula.

The broken line indicates that the volume of a tree 44 inches in diameter at breast height and 32 inches in diameter at one-half the height and 120 feet tall is 645 cubic feet.

combined, while those of intermediate size are applicable either to combinations of I and B or II and A, and are so designated. This combination of scales at first seems complicated, but gives great flexibility to the graph and yields values over a very large range of sizes, while obviating errors from abnormally acute intersections.

SMALIAN FORMULA USED FOR ENTIRE TREES

The Smalian formula already described is sometimes used for obtaining the volume of entire trees with a single computation, based on measurements at equal intervals along its stem. The formula becomes

$$V = (b_1 + 2\,b_2 + 2\,b_3 + 2\,b_4 \quad . \quad . \quad . \quad . \quad 2\,b^{n-1} + b_n)\,\frac{L}{2},$$

where V is the volume of the tree in cubic feet, b_1, b_2, ... b_n, etc., the basal areas at the first, second, ... and *n*th sections, and L the length (or average length) of section or log. If d_1, d_2, ... d_n, etc., are diameters at the successive sections, this may be written

$$V = (\tfrac{1}{2}d_1^2 + d_2^2 + d_3^2 + d_4^2 \quad . \quad . \quad . + d^{n-1\,2} + \tfrac{1}{2}d_n^{\,2})\,\frac{\pi L}{4 \times 144}.$$

An alinement chart for this equation involves no new principles, but certain difficulties as to arrangement and scale are encountered. It necessitates first the successive addition of an unknown and varying number of *d* values, followed by the multiplication of the sum by the expression involving L. The addition must obviously be handled by the parallel line form of chart and the multiplication by the *z* form. On account of difficulties with the scales two forms of this chart have been prepared, each of which has certain advantages one over the other.

Figure 14 has a series of 9 parallel axes for performing the addition. From what has been said in connection with figure 7, it is evident that three axes are necessary for the addition of two variables, 5 for 3 variables, 7 for 4 variables, etc. A seven-log tree with its 8 different values for *d* would therefore require 15 axes. These would be exceedingly confusing, however, and in the plate presented they have been so combined as to reduce them to the number shown. The principle on which this combination is effected is that in figure 7: C and D can be made to coincide by making the intervals between A, B, C, D, and E equal. There must then be two series of graduations on the combined CD axis. If this principle is adopted, it is evident that each new variable to be added requires but one additional axis instead of two.

The only complication in working out this system of axes is con-

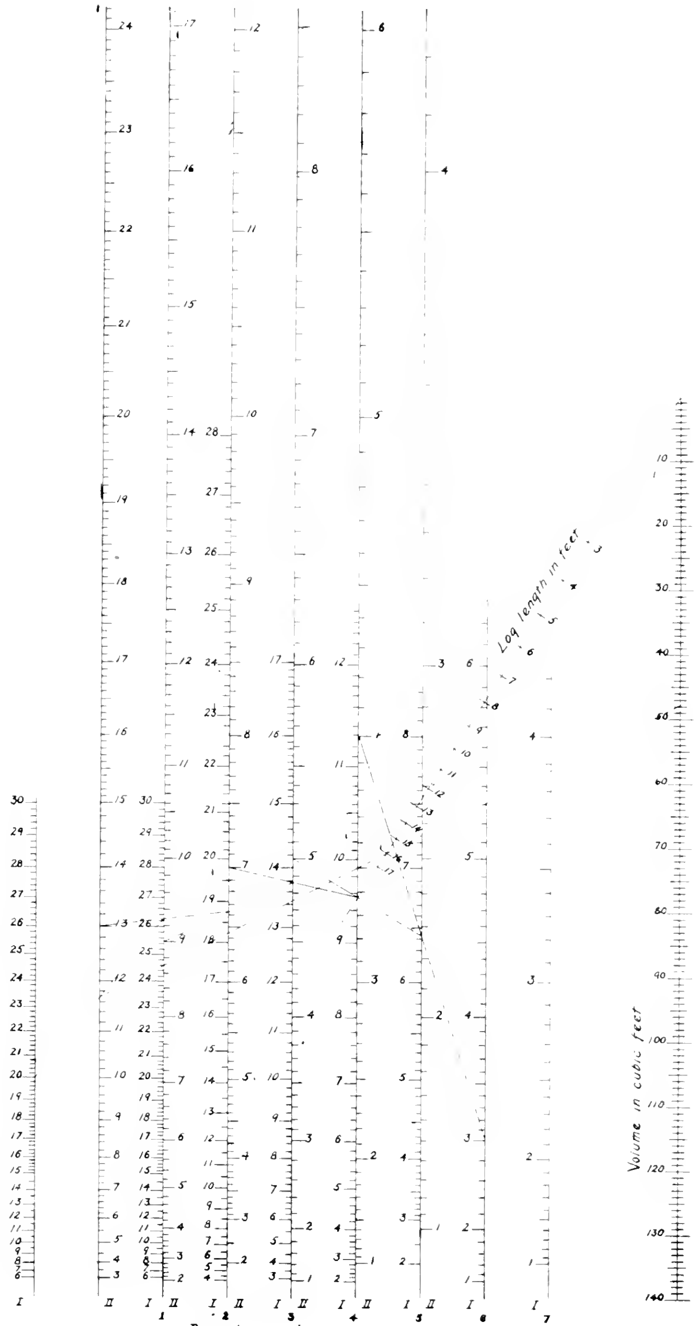


FIG. 14.— Graph for finding volumes of whole trees in cubic feet by Smalian formula.

The broken line indicates that the volume of a 6-log tree which measures in diameter at successive sections 16 feet apart 3, 4, 5, 7, 9, 13, and 20 inches is 47.8 cubic feet.

nected with the scales. The axis designated 7 and that designated 5 may be considered as the initial axes, which should therefore be graduated on the same scale. The 6 axis, lying between them, is the final axis of this first system, and as such should be graduated to one-half the scale. These graduations are, however, never read and do not appear. Six then becomes the initial axis in a combination composed of 4, 5, and 6. Four should therefore be graduated with the same unit as 6, namely, ½ of that used for 7. Five now becomes the final axis of this second combination, and as such would be read, using a unit again divided by 2, or one-fourth as great as the unit originally used. This, however, need not appear on the axis. Five next serves as an initial axis in the 3, 4, 5 combination, with the result that 3 is graduated with a unit one-fourth as large as the original unit. In a similar way the addition proceeds across the chart from right to left. It will be noted that each of the interior axes serves in a threefold capacity: first, as an initial axis of the combination lying to the right; second, as the final axis of the combination of which it is the center; and, third, as the initial axis of the combination lying to its left. In these three functions two different scales for each are involved, but the graduations need be read only in the first, as in the other cases a point located by intersection is merely held and used as a starting point for the next operation. The unnumbered axes to the left function obviously in but a single or dual capacity.

So far the fact is neglected that the first and last values are divided by two in our equation. It is necessary on this account to graduate each axis which may serve as a starting point or a terminal point to correspond to ½ D^2 as well as to D^2. To distinguish them, this series of graduations are placed on the left of all axes. Certain axes for obvious reasons only require one of the two sets of values—that is, either the ½ D^2 or the D^2, while others require both.

The final sum of all the additions is accumulated on the second vertical axis from the left. This sum cannot, however, be read from its graduations, since these apply only to its function as an initial axis in connection with axes 1 and 2, the other set of graduations applying to its function as a final axis, being for simplicity omitted. The V scale at the right is graduated regularly in any convenient unit. The diagonal L scale connecting the origin of the V scale with that of the second axis from the left is graduated by intersections from one or more known points, which are themselves found by intersection in the manner previously described. To avoid complicating the appearance of

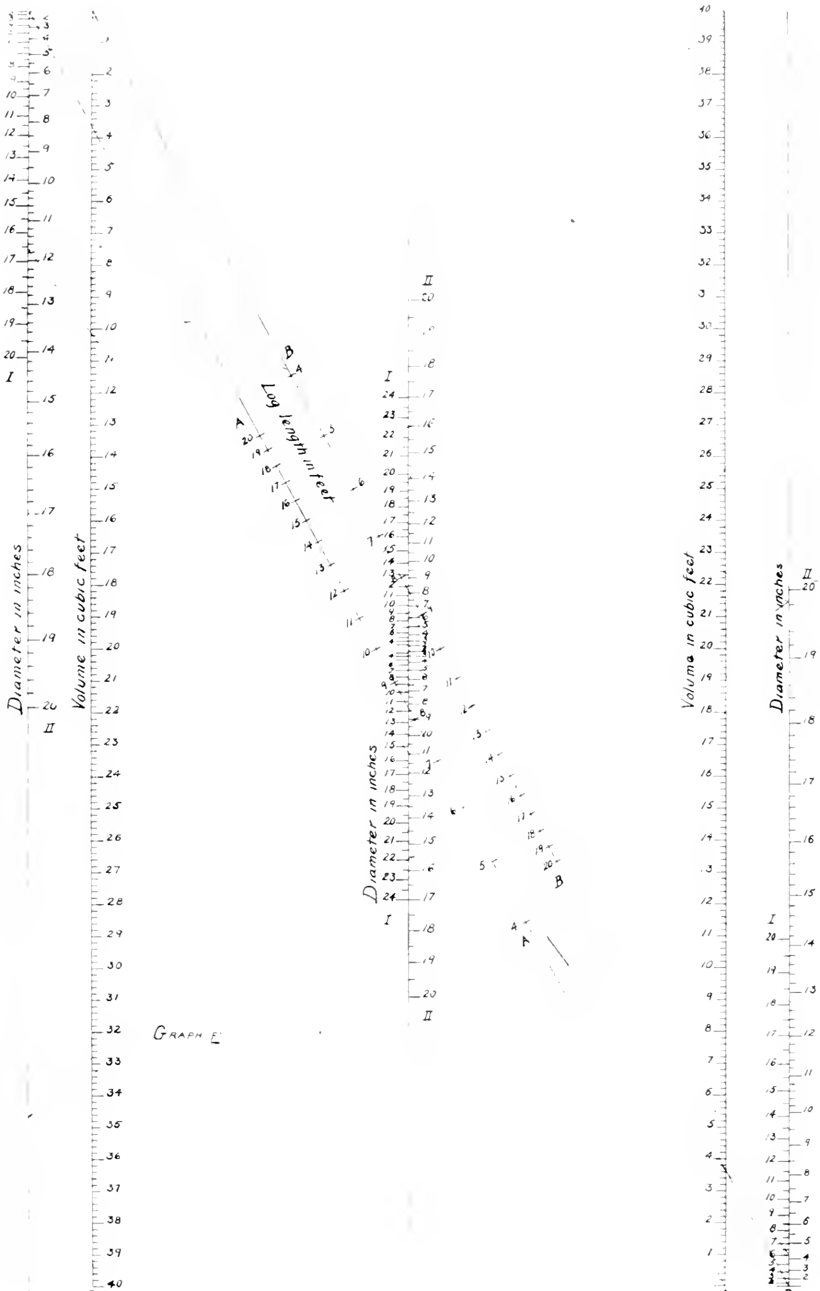


FIG. 15.—Graph for finding volumes of whole trees in cubic feet by Smalian formula.

The broken line indicates that the volume of a 3-log tree which measures in diameter at successive sections 12 feet apart 6, 11, 16, and 22 inches is 25.55 cubic feet.

the chart, only that portion of the diagonal axis upon which graduations appear is drawn.

The difficulties involved in constructing a chart of this form will be apparent from what has already been said. As one proceeds to the left across the chart, the graduating unit becomes smaller in an inverse geometrical progression. Since the larger diameters of the tree are in the lower logs, this tendency is helpful up to a certain point, but as a matter of fact the progression rapidly becomes so marked that the left-hand scales are progressively harder to read to the desired degree of accuracy. This tendency limits the number of logs for which such a chart can be readily prepared. On the other hand, the capacity of such a chart in volume is very great, and it will be found better suited than the next plate to the case of large, short trees.

It is possible to use this chart for trees with a larger number of logs than are provided for, by dividing the tree into two parts and computing the upper and lower parts separately. Thus, a 9-log tree can be computed as a 5 and a 4, or as a 6 and a 3, and the results added together.

Figure 15 is a second chart for performing this same operation. In this the number of axes in the addition system is reduced to 3 by using in a reverse direction the subtraction graph which has been illustrated in figure 3. It will be noted that the outer right-hand axis is graduated from the bottom upward, the outer left-hand axis from the top downward, and the intermediate axis from the center both up and down. Each axis has two sets of graduations, one for d^2 on the right and one for $\frac{1}{2}\ d^2$ on the left, as in the case of the plate already described. In each addition in this case one of the outer axes and the central axis are the initial and the other outer axis the final. In working from right to left the lower half of the central axis is used, and in working from left to right the upper half. First and last values of D are read on the left-hand, or I, scales and all intermediate values on the right-hand, or II, scales. The final sum may appear on either one of the two outer axes, according to whether the number of logs was odd or even and according to the axis from which the computation was started. There are, therefore, two identical z charts, symmetrically placed, one for use with each of the outer D axes. On the vertical members of these a regularly graduated volume scale is placed, using any convenient unit, and the diagonal L scales are graduated by intersections, as has already been described.

This chart avoids the difficulty of a geometrical progression in the scale units, but introduces a difficulty, in that if a reasonably large scale for *d* is employed, only limited values of V are practicable. Thus, figure 16 will serve for trees whose volumes do not exceed 40 cubic feet, while figure 15 is applicable through a range over three times as great. Figure 16, however, is entirely independent of the number of logs. It is, therefore, preferable for very tall, slender trees. It can be used for computations beyond its range by dividing a tree into two or more parts and calculating each part separately and adding their sum.

CONCLUSIONS

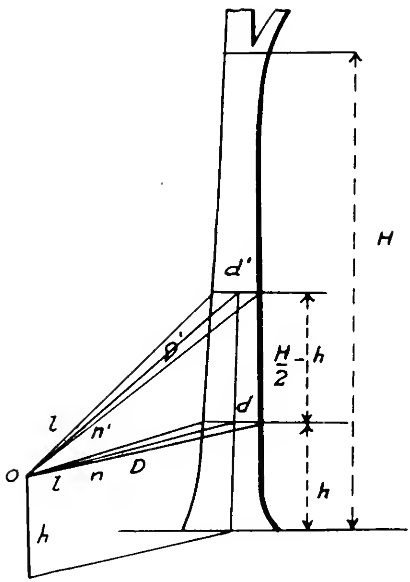
The advantages of this graphic method as compared to ordinary computations are speed and consequent low cost. The actual saving depends upon the particular formula in question and on the personal equation of the computer; but it appears that the graphic solution saves from 80 to 90 per cent of the time of the complete computation and about 50 per cent of that where use is made of all available tables and of the slide rule. It is evident that a saving can often be made, even where the graph must be prepared specifically for a given problem.

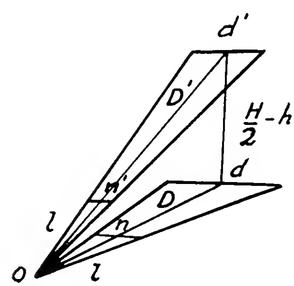
The advantages of the alinement form of graph as contrasted with that using rectangular co-ordinates are the following: First, it is simpler in appearance. This greatly reduces the strain on the eyes which results from using a chart involving a complicated maze of curves crossing the lines of the co-ordinate paper. Second, it can in most cases be constructed more quickly and more cheaply, when once the principles involved are well understood. Third, interpolations are readily handled in any one of the variables, while in the series of curves that result from plotting a three-variable equation in rectangular co-ordinates interpolations betwen the curves are always uncertain and unsatisfactory.

DETERMINATION OF THE MIDDLE DIAMETER OF A STANDING TREE[a]

By P. d'Aboville

The diameter at the middle of the trunk of a standing tree, which is necessary in order to determine its contents, cannot be measured directly. It is necessary, therefore, to have recourse to a coefficient of form which, multiplied by the diameter at the butt, will give the diameter sought.





If f represents the coefficient of form, d the diameter of the butt at the height of one's eyes, and d' the diameter at the middle of the trunk, then

$$d' = d \times f.$$

This coefficient of form is variable. It changes not only from one forest to another, according to the site and to the nature and age of the stand, but also from one species to another, and often for each tree of

[a] Translated by Samuel T. Dana, U. S. Forest Service, from an article entitled "Détermination du diamètre au milieu du tronc de l'arbre sur pied," in the Revue des Eaux et Forêts for June, 1919.

the same species, according to conditions of vegetation. Ordinarily it is determined by previous measurements of felled sample trees selected at random in the forest where one is working. This method, while not bad, has nevertheless the inconvenience of being only approximate, since one proceeds by comparison. It is, moreover, as radical as it is slow, since it necessitates cuttings which require both labor and time. Finally, it obliges the felling of trees the cutting of which would not be desirable under certain circumstances.

The following method permits the direct determination of the coefficient of form of any standing tree, thanks to the application of a very simple formula which any estimator is capable of using on the ground:

Let n and n' = the apparent diameters viewed from a point O of the diameters d and d' on the tree at the height of the eye and at the middle of the trunk;

l = the distance from O to a graduated scale (held at arm's length) on which n and n' are measured;

D = the horizontal distance from O to d;

D' = the distance from O to d';

H = the height of the trunk;

h = the height of the observer's eye above the ground.

Then, as a result of the properties of similar triangles,

$$\frac{n'}{d'} = \frac{l}{D'} \text{ and } \frac{n}{d} = \frac{l}{D}.$$

From these two equations $\dfrac{n'D'}{n\,D} = \dfrac{d'}{d}$.

Since $\dfrac{d'}{d} = f$ by definition, $\dfrac{n'D'}{n\,D} = f$ (I).

This formula can be further simplified when $D = \dfrac{H}{2} - h$ (the distance from d to d').

Squaring equation (I), we get

$$\frac{n'^2D'^2}{n^2\,D^2} = f^2 \text{ (II)}.$$

$D'^2 = D^2 + \left(\dfrac{H}{2} - h\right)^2$ in the right triangle formed by D, D', and $\dfrac{H}{2} - h$.[b]

[b] It will be noted that this is a right triangle only when the line from the observer's eye to the tree is a horizontal one, and that the method is therefore applicable only on level or nearly level ground.—S. T. D.

Replacing $\left(\frac{H}{2} - h\right)^2$ by its value D^2, we get

$$D'^2 = D^2 + D^2 = 2D^2.$$

Substituting this value of D'^2 in equation II, we get

$$\frac{2\,n'^2\,D^2}{n^2\,D^2} = f^2;\ \text{and simplifying}$$

$$\frac{2\,n'^2}{n^2} = f^2,\ \text{or}\ f = \frac{n'}{n}\sqrt{2}.$$

Since $\sqrt{2} = 1.414$,

$$f = \frac{n'}{n} \times 1.4.$$

When, therefore, $D = \frac{H}{2} - h$, the coefficient of form of any given tree equals the quotient of the apparent diameter at the middle of the trunk divided by the apparent diameter at the height of the observer's eyes, multiplied by the constant 1.4.[c]

The actual steps necessary to determine the coefficient of form of a standing tree may be summarized as follows:

a. Measure the height H of the trunk by eye or by one of the well-known methods, and, once for all, the height h of the observer's eye above the ground.

b. Walk to a distance from the tree equal to half the height of the trunk minus the height of the eye above the ground. Practical experience has proved that it is sufficient to walk to a distance from the tree approximately equal to half the height of the trunk in order to determine without appreciable error the apparent diameters n and n'.[d]

c. From this point determine the apparent diameters n and n' on a graduated scale held at arm's length and parallel to the line between the eyes and directed successively at the height of the eyes on the tree and at the middle height of the trunk.

Let us suppose that for a given tree the observer, the height of whose eyes above the ground equals 1.5 meters, finds that H = 9 meters. To determine the coefficient of form f of this tree it is sufficient to walk to

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[c] The same formula can evidently be used to determine the diameter at any given point on the tree, provided one stands at a distance from the tree equal to the height above the ground of the point at which the diameter is to be measured minus the height of the observer's eyes above the ground. In this case f, instead of being the ratio between the diameter at the middle height of the trunk and the diameter at the height of the eyes, is the ratio between the diameter at the point selected and the diameter at the height of the eyes.—S. T. D.

[d] See comment by Mr. Sparhawk in regard to this point.—S. T. D.

a distance of $\frac{9}{2} - 1.5$, or 3 meters, from the foot of the tree, and from this point measure n and n' as explained above.

He finds, for example, in an actual case that $n' = 3$ and $n = 5$.

Then the desired coefficient of form

$$f = \frac{n'}{n} \times 1.4 = \frac{3}{5} \times 1.4 = .6 \times 1.4, \text{ or}$$
$$f = .84.$$

The product $\frac{n'}{n} \times 1.4$ can be easily calculated in the head. It equals in effect the sum $\frac{n'}{n} + \frac{n'}{n} \times .4$, or in the example above $.6 + .6 \times .4$, or $.6 + .24 = .84$.

This method for determining the coefficient of form is generally applicable. Repeated tests have proved that it is accurate, and consequently susceptible of rendering real service in estimating standing trees.

Comment by W. N. Sparhawk:

For work requiring a considerable degree of accuracy the method described must be used with a great deal of care. Due allowance must be made for height of the eye, care must be taken that the observer stands on the same level as the tree (or, on slight slopes, addition or deduction may be made for the difference in level when allowing for the height of the eye), and the readings of apparent diameters must be made on the right points on the bole.

Failure in these respects will lead to rather serious errors in the results. For instance, take a tree 20 inches d. b. h. with a 50-foot merchantable bole and a diameter at the middle of 16 inches. Accurate use of the above method will give $f = .8$, whence d' (computed from $d = 20$) will be 16 inches. If, however, readings are made from a point 25 feet from the tree (no allowance for height of eye), f will be .88 and $d' = 17.6$ inches, or 1.6 inches too high.

If the tree stands on a 15° slope and the readings are made at the correct horizontal distance from it, but directly downhill from it, f will be .72 and $d' = 14.4$ inches. If the distance is measured along the slope and not corrected to horizontal, $d' = 14.2$ inches. If readings are made on the same slope above the tree, results will be 18.9 and 18.6 inches respectively.

Errors due to reading apparent diameters too high or too low on the bole should not be very serious, except where the taper is great, since they will amount approximately to the difference in diameter between the points which should have been measured and those actually measured. Thus, in case of a tree with 1-inch taper per 6 feet of bole, as in the example given, an upper reading will have to be taken at 6 feet above or below the middle of the stem to throw the result 1 inch below or above the correct figure.

THE ROYAL ITALIAN FORESTRY COLLEGE

By Nelson Courtlandt Brown

U. S. Trade Commissioner

Forestry education in Italy is entirely in the hands of the central government at Rome, the funds for its support being part of the general forestry appropriation, and is supervised by the Director General of Forests under the Minister of Agriculture. Important reforms in the laws of 1910, 1911, and 1912 have given forestry generally in Italy a new and important impetus, and along with this movement the organization of technical education in forestry has been entirely rearranged along new lines. It consists chiefly of a new location and organization of the graduate school of forestry and the two ranger schools.

Forestry education in Italy dates back to 1869, when Italy became for the first time a unified nation under the leadership of the great national heroes, Victor Emmanuel, Garibaldi, and Mazzini. Before that time Italy was made up of a number of small kingdoms, duchies, principalities, and Papal States, many of which were highly jealous of each other and which left a heritage of heavy financial debts, impoverished forest resources, and disturbed political and economic conditions. In the year 1869 the old Benedictine monastery at Vallombrosa, in the mountains of Tuscany, was given over to the Royal Forestry Institute. Both the faculty and students lived in the former monks' cells. Although the funds available for educational purposes were very limited for a long period, the school flourished and has turned out an excellent type of technical forester. Many of its graduates, after completion of the course at Vallombrosa, have continued their technical education at the forest schools and in travel in Austria, France, Germany, and Russia, and the personnel of the Italian force ranks on a par with that of any other European country. An exceedingly high type of personnel has been attracted to the work, and, under the conditions of rather limited facilities in funds, together with the limitations of the law and the discouraging forestry conditions, the progress made has been admirable.

The forest at Vallombrosa is most excellently adapted for the field purposes of a forest school, a tract of timber of about 3,500 acres being available for experimental and practitional purposes. This mon-

astery was founded in the twelfth century, and ever since its establishment the forest has been tended by the monks, at least in a cursory fashion, along forestry principles.

It consists chiefly of silver fir, together with pure stands of chestnut, beech, pine, and a little oak. It has a large forest garden, with over 3,000 tree species, from all parts of the world, and seven experimental nurseries. It is situated about 34 miles from Florence and at an elevation of about 3,200 feet, overlooking the beautiful Arno Valley. It is within easy reach of several other important forests of central Italy, such as La Verna, Mandrioli, Camaldoli, and Boscolunga, along the higher reaches of the Apennine Mountains.

Under the laws of 1911, the school was moved to the Cascine Gardens, in the outskirts of Florence, where there are three well-equipped buildings now occupied by the school. The official name was changed to "Reale Istituto Superiore Forestale Nazionale," which, literally translated, means the Royal Superior National Forestry Institute, but in the parlance of educational circles in this country it should be translated as the Royal Forestry College.

It still retains Vallombrosa as a summer headquarters, where students spend from July 1 to July 15 and from September 15 to October 1 of each year, the interim between being spent in visits to other Italian forests on trips of inspection.

There are two ranger schools in Italy, both of which are maintained and supported by the government out of the general forestry appropriation. These are located at Citta Ducali, in the Abruzzi, near Aquila, and the other at Vallombrosa. Both of these ranger schools offer one-year courses, and there are three degrees given, namely, those of forest guard, forest brigadier, and forest marshal. The ranger students go first to the school at Citta Ducali for a period of one year. When they have completed this course they enter the forest service as guards. Those who wish and are competent to rise to higher ranks are selected for the purpose, and after a period of three years in the forest after graduation from this school are sent to Vallombrosa for one year, after which they receive the degree of forest brigadier. A few of the most proficient men receive the degree of forest marshal. Before the war, there were 150 students in the class at Vallombrosa and 300 in the class at Citta Ducali. While at the latter school the men receive 1,200 lire, or about $240, per annum, but this has been increased to 1,600 lire, or $320, per annum. At Vallombrosa the ranger students receive 1,800 lire, or approximately $360, per annum upon graduation as brigadiers,

while those who receive the degree of forest marshal are given 2,400 lire, or about $480, per annum. While at Vallombrosa the students receive 2 lire, or about 40 cents, extra per day for subsistence.

The Italian Forest Service, the official name of which is "Corpo Reale delle Foreste," and which is also referred to in official documents as "Servizio Forestale dello Stato," had an annual appropriation prior to 1910 of only 600,000 francs, or the equivalent of about $120,000. From that year and until Italy's entrance into the war, on May 23, 1915, it had an annual appropriation of 5,000,000 lire, or about $1,000,000, which compares very favorably with government appropriations, according to areas and personnel, in any of the countries actively engaged in a definite forestry policy. From the above appropriation the funds made available for the Royal Forestry College amounted to 200,000 lire, or about $40,000, since its permanent establishment in Florence, in 1913. This compares very favorably with the financial support available for professional schools in this country. During the war full appropriations were continued for this school, whereas those for the ranger schools were eliminated. Neither the ranger schools nor the professional school at Florence had any students during the war, as every one was in the army. Many of the faculty of both the ranger schools and the forestry college were in active service at the front and the casualty lists have included several of the best-known Italian foresters.

The Royal Italian Forestry College, according to the law of July 14, 1912, and the amendment of February 6, 1913, has two essential functions, one being didactic and the other study and experimentation. The former, according to the law, provides a two-year graduate course in professional forestry for graduates of recognized engineering and agricultural schools. It also confers diplomas of professional efficiency upon those who have attained particular proficiency in the technical work of the State administration, and admits as auditors those who wish to acquire a greater knowledge in one or more branches of forestry. The students in the regular course are officially a part of the royal corps of foresters and are only admitted to this school as such.

Students are admitted to the school on the basis of competitive examinations, and are given the title of adjutant assistant inspector of forestry in the Royal Forestry Corps on successful completion of this competitive examination. The number of these students is determined annually by the school board, and in the past they have included from 30 to 50 in each class. The students of the school receive a yearly stipend of 2,500 lire, or about $500, for maintenance expenses.

Each of the two years is divided into two periods, namely, the scholastic period, in Florence, from October 15 to June 15, and the second period, for field activity and inspection work, from July 1 to September 30. A vacation is allowed from October 1 to October 15 and from June 15 to June 30 of each year. The following table shows the subjects offered and the number of hours per week devoted to each subject:

Subject.	Hours per week. First year.	Hours per week. Second year.
1. Silviculture and mountain culture	3	2
2. Economics and forest mensuration	..	4
3. Technology and utilization of woods	..	2
4. Administration and organization	3	2
5. Hydraulic forestry systems	..	2
6. Forest construction	2	..
7. Construction of forest roads	1	..
8. Forest botany (phytography and botanical geography)	3	..
9. Forest pathology	..	3
10. Forest zoology	..	1
11. Forest chemistry	2	..
12. Mineralogy and forest geology	3	..
13. Forest legislation and administration	..	2
14. Administrative equity and the law of civil and penal justice	2	..
Total hours per week	19	18

At the end of each course and year the pupil takes an examination, and at the end of two years a general examination, consisting of a written theme developed by the pupil and selected from one of the following subjects: (1) Forest economics; (2) Forest valuation; (3) Technology and utilization; (4) Silviculture; (5) Organization and construction.

Since the future of industrial Italy lies largely in the development and utilization of water-power properties, a great deal of attention has been given to what is called "hydraulic forestry." Considerable attention is also paid to the construction of forest roads and other construction work and to reforestation. The latter impresses one as being the most pressing single need of the Italian situation.

Scientific investigation and experimentation are expected to occupy at least one-half of the time and efforts of the faculty. The character of the investigations is determined and supervised by an academic board under the general direction of the Director General of Forestry at Rome. The faculty consists of six professors, four associate professors, and eight assistant professors and such other forestry officials as may be called to the college for special lectures from time to time. There are also a secretary, librarian, and assistant secretary and two

general assistants. The college is excellently equipped with a very complete library and museum and its has seven laboratories devoted respectively to: (1) Silviculture; (2) Technology and utilization; (3) Forest mensuration and valuation; (4) Botany; (5) Physiology and pathology; (6) Forest chemistry; (7) Mineralogy and geology.

The three buildings are very large and capacious and are attractively located on the Piazzale del Re, in the Cascine Gardens. The largest of the three contains, aside from the offices of the director and faculty, the library, museum collections, recitation rooms, and forestry laboratories: the second building is devoted to forest pathology, botany, and zoology, and the third is given over to class-rooms and laboratories for mineralogy and geology. The entire space covered by the three buildings is more than an acre and altogether the school grounds include about six acres. The school also retains control over the nurseries, arboretum, and buildings of the former institute at Vallombrosa.

In order to be admitted to the College of Forestry, it is necessary to present, together with the application for admission, not later than September 1 of each year, the following documents: (1) Diploma in agricultural science or engineering from a college of recognized standing; (2) Certificate of birth; (3) Papers of Italian citizenship; (4) Certificate of good conduct issued by the mayor of the commune where the aspirant habitually resides; (5) General certificate of the judicial district, not anterior in date to three months; (6) Summary of the scholastic career accomplished.

Prior to graduation, severe examinations are held to determine the knowledge of the candidate for various positions to be offered in the forestry service.

On July 1, 1913, the following arrangement of classes and grades, together with payment, was provided for. Upon successful completion of the technical course, the men are given positions in this service as vacancies occur:

Classes and grades.	Individual stipend in lire.	Approximate equivalent in dollars.
Chief inspectors of first class	9,000	$1,800
Chief inspectors of second class	8,000	1,600
Chief inspectors of third class	7,000	1,400
Inspectors of first class	6,000	1,200
Inspectors of second class	5,000	1,000
Assistant inspectors of first class	4,000	800
Assistant inspectors of second class	3,500	700
Assistant inspectors of third class	3,000	600
Adjutant assistant inspectors	2,500	500

[1] Although the normal par gold rate of exchange is 19.3 cents, the equivalent of one Italian lira, 20 cents is generally adopted for means of approximate conversion and has been used throughout this article.

The organization within the forestry service consisted of the following forest officers at the outbreak of the war, in May 1915: 13 chief inspectors, 47 inspectors, 280 assistant inspectors, 16 head marshals, 175 marshals, 425 brigadiers, 2,400 guards.

The following is a list of the professors of the Royal Forestry College for each of the principal subjects as organized in 1915:

Prof. Alberto Cotta for silviculture and technology.

Prof. Manfredi De Horatiis for hydraulic engineering and construction.

Prof. Giuseppe Di Tella for mensuration and valuation.

Prof. Adriano Fiori for forest botany.

Prof. Alessandro Martelli for mineralogy and geology.

Prof. Carlo Palazzo for forest chemistry.

Prof. Andrea Parascandolo for forest roads and topography.

Prof. Arrigo Serpieri for forest economics.

Prof. Romualdo Trifone for forest law and administration.

BORDERED PITS IN DOUGLAS FIR: A STUDY OF THE POSITION OF THE TORUS IN MOUNTAIN AND LOWLAND SPECIMENS IN RELATION TO CREOSOTE PENETRATION

By Gertrude J. Griffin

Assistant Xylotomist, Forest Products Laboratory

In commercial practice Douglas fir is regarded as a difficult conifer in which to obtain good creosote penetration.

Earlier investigations, conducted at the Forest Products Laboratory of the Forest Service, Madison, Wisconsin, and elsewhere, indicated that the bordered pits are of considerable significance in relation to penetrance in conifers.

The purpose of this study was to secure definite information as to the position of the tori of the bordered pits in Douglas fir, as found under a variety of conditions, and to determine, if possible, the effect of these on penetration with creosote.

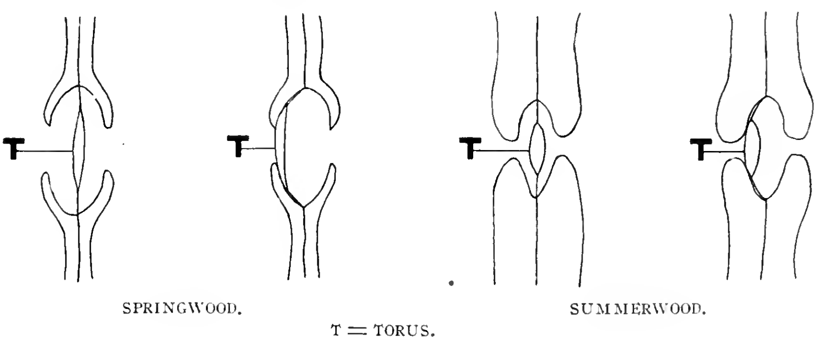

Fig. 1.—Douglas fir bordered pits.

In figure 1 diagrams are given of two springwood bordered pits, showing the relatively thin walls, the rather long overhang of the borders, and the general shape of the pit cavity. The characteristic thin-pit membrane, with its thickened portion (the torus "T") of the springwood pit, is shown in contrast to the appearance of this structure in the summerwood. In the two summerwood pits the typically thicker walls, smaller cavity, and thicker, shorter torus are noticeable. In one bordered pit of the springwood and one of the summerwood the torus

TABLE 1.—*Positions of the Tori in Bordered Pits in Green Untreated Douglas Fir.*

Source of material.	Description of specimen.	Location of Tori. Heartwood. Springwood. Asp.[1]	Heartwood. Springwood. Cen.[2]	Heartwood. Summerwood. Asp.	Heartwood. Summerwood. Cen.	Sapwood. Springwood. Asp.	Sapwood. Springwood. Cen.	Sapwood. Summerwood. Asp.	Sapwood. Summerwood. Cen.	Total tori examined.
San Miguel County, New Mexico (mountain-grown).	Shipment 466, No. 8	[3]	..	13	12	..	..	2	8	35
	Shipment 466, No. 12	..	..	3	7	..	..	1	8	19
	Shipment 466, No. 28	..	..	6	4	..	..	7	8	25
	Shipment 466, No. 34	..	..	0	10	..	..	0	10	20
	Shipment 466, No. 37	..	..	11	8	..	..	5	15	39
	Shipment 466, No. 41	..	..	12	8	..	..	8	12	40
	Shipment 466, No. 48	..	..	3	7	..	..	0	10	20
Total tori for mountain-grown specimens..........		..	..	48	56	..	..	23	71	198
Everett, Wash. (lowland-grown).	Shipment 456, No. 15	10	0	1	9	..	..	..	..	20
	Shipment 456, No. 17	..	..	..	..	0	10	0	10	20

[1] Asp., aspirated, torus not in central position in the pit cavity.
[2] Cen., central, torus in central position in the pit cavity.
[3] Blank spaces indicate no examinations made.

is shown in a central position, equally dividing the pit cavity. In the other two bordered pits the torus is pressed to one side against the opening of the pit cavity, completely closing it. For convenience and brevity in describing this position of the torus, the term "aspirated" is here used.

The investigation was divided into three parts:

1. The study of the position of the tori of the bordered pits as found under rather ordinary circumstances, as, for example, in green, air-dry, and oven-dry wood.

2. The study of material which had been penetrated with creosote to varying extents. This work was undertaken with a view to determining whether the tori of the bordered pits were always in the same position whenever the material failed to absorb as much oil as was expected.

3. A series of experiments was made to determine whether the tori could be displaced or held fixed in any given position by artificial treatments of small blocks. The test specimens were subjected to air pressure, steam and creosote treatments, and soaking in alcohol followed by oven-drying, respectively.

CONDITION OF THE TORI IN BORDERED PITS IN NATURAL WOOD OF DIFFERENT MOISTURE CONTENT

Green Material.—Material from two specimens of coast, or lowland-grown, Douglas fir from Everett, Washington, and from seven specimens of mountain-grown Douglas fir from San Miguel County, New Mexico, was available for this study. A comparison of the heartwood and sapwood portions of both of these groups of material was made. A relatively small number of the springwood pits were examined. The greater part of the investigation was conducted on the summerwood pits, since the summerwood is the region where penetration is most general. The results of the microscopic examinations are given in Table 1.

It is of particular interest to note that, in the summerwood of the mountain-grown specimens especially, a considerable number of the tori of the bordered pits were not in the central or generally considered usual position, but had been displaced or aspirated—that is, moved to one side of the pit cavity.

Air-dry Material.—One untreated specimen of air-dry mountain-grown Douglas fir, from Missoula County, Montana, and one specimen of untreated air-dry Douglas fir from a tree which had grown half way

TABLE 2.—*Positions of the Tori in Bordered Pits in Air-dry Untreated Douglas Fir.*

Source of material.	Description of specimen.	Location of Tori.								Total tori examined.
		Heartwood.				Sapwood.				
		Springwood.		Summerwood.		Springwood.		Summerwood.		
		Asp.	Cen.	Asp.	Cen.	Asp.	Cen.	Asp.	Cen.	
Missoula County, Mont. (mountain-grown).	Shipment 370, No. H-23	9	1	34	1	..	..	..	..	45
Snoqualmie National Forest, Wash. (half way up mountain).	Wood-collection Proj. 113-79.	..	..	20	3	..	..	17	7	47

TABLE 3.—*Positions of the Tori in Bordered Pits in Untreated Oven-dry Douglas Fir.*

Source of material.	Description of specimen.	Location of Tori.				Total tori examined.
		Heartwood.				
		Springwood.		Summerwood.		
		Asp.	Cen.	Asp.	Cen.	
Everett, Wash. (lowland-grown)......	Shipment 456, tie No. 15..............	10	0	8	2	20

TABLE 4.—*Positions of the Tori in Bordered Pits in Green Douglas Fir Treated with Creosote*

Source of material	Description of specimen.	Treatment. Preliminary treatment.	Treatment. Vacuum.	Treatment. Pressure.	Treatment. Kind of oil.	Treatment. Total time.	Results of treatment. Absorption.	Results of treatment. Penetration.	Location of Tori. Heartwood. Springwood. Asp.	Springwood. Cen	Summerwood. Asp.	Summerwood. Cen.	Total tori examined.
Everett, Wash.	Shipment 456 tie No. 9.	Heated in oil at atmospheric pressure 190 F.—5½ hrs	14⅓ hrs.	Reached 135 lbs. at end of fourth hour	Coal tar creosote.	25⅓ hrs.	12½ lbs. per cu ft.	Good	10	0	3	7	20
Everett, Wash.	Shipment 456 tie No 12.	Heated in oil at atmospheric pressure 190° F.—5½ hrs.	Gradually raised to 27" in 52.5 hrs. Total, 14 hrs	Reached 135 lbs. at end of fourth hour.	Coal tar creosote	24¾ hrs	12.4 lbs per cu. ft.	Good[1]	22	8	1	9	40
Everett, Wash	Shipment 456 tie No. 13.	Heated in oil at atmospheric pressure 190 F.—5½ hrs.	Gradually raised to 27" in 52.5 hrs. Total, 14 hrs	Reached 135 lbs at end of fourth hour.	Coal tar creosote.	24¾ hrs	12.4 lbs per cu. ft.	Good	10	0	7[2]	3	20
Everett, Wash	Shipment 456 tie No 16.	Heated in oil at atmospheric pressure 190° F. 5½ hrs.	14⅓ hrs.	Reached 135 lbs. at end of fourth hour.	Coal tar creosote.	25¼ hrs	12½ lbs. per cu. ft.	Good	5	5	2	8	20
Total tori for lowland-grown specimens									47	13	13	27	100

[1] In two of the small specimens of this tie examined with the microscope (ten springwood pits in each specimen), the penetration appeared very good in both the springwood and summerwood in one instance and good in the summerwood in the other.
[2] This shows a striking difference from the results noted for lowland-grown green material in Table 1. It is possible that this specimen may have dried out to some extent, causing the aspirated condition before treatment, although it was classed with the other specimens as green material.

TABLE 5.—*Positions of the Tori in Bordered Pits in Air-dry Douglas Fir Treated with Creosote*

Source of material.	Description of specimen.	Treatment. Preliminary treatment.	Treatment. Vacuum.	Treatment. Pressure.	Treatment. Kind of oil.	Results of treatment. Absorption	Results of treatment. Penetration.	Location of Tori. Heartwood. Springwood. Asp.	Springwood. Cen	Summerwood. Asp.	Summerwood. Cen.	Total tori examined.
Missoula County, Mont (mountain grown)	Shipment 370, stick No. H-23	. . .	. . .	20 lbs for 20 min at 180° F	. . . . . .	. . . .	Poor.	20	0	19	1	40
Montana (mountain grown).	. . . .		. .	. . .	. . . .	. . . .	Practically none		. .	14	6	20
Plumas County, Cal (mountain grown).	. . . . .	. . . .	. . . .	. . . .	. . . .	. . . . .	Practically none.	.	. . . .	21	8	29
Lewis County, Wash. (mountain grown)	Shipment 315, tree No 8	Heated in oil at atmospheric pressure 190 F. 3¾ hours	4 hours	Reached max of 150 lbs at end of 3d hour Total, 6½ hrs.	Coal tar creosote.	. . . . .	Practically none.	10	0	8	2	20
Lewis County, Oregon (mountain grown)	Shipment 318, tree No 8	. . . . . .	½ hour after reaching 26".	175 lbs. per sq in at end of 1st hr 180 F 2½ hours.	Coal tar creosote.	. . .	Practically none.	8	2	10	1	21
San Miguel County, New Mexico (mountain-grown)	Shipment 466, tree No. 12.	. .	. . . . . .	. . . .	. . . . .	4.2 lbs. per cu ft.	Poor	10	0	8	2	20
San Miguel County, New Mexico (mountain-grown).	Shipment 466, tree No. 28.		. . .	.	. . .	2.0 lbs. per cu ft.	Practically none.	10	0	8	2	20
San Miguel County, New Mexico (mountain-grown).	Shipment 466, tree No 28.	.	. . . . . .	. . . .	. . . .	1.6 lbs. per cu. ft.	Practically none.	10	0	10	0	20
San Miguel County, New Mexico (mountain-grown).	Shipment 466, tree No 41.	.	. . . .	. . .	.	1.0 lb. per cu. ft.	Practically none.	10	0	9	1	20
San Miguel County, New Mexico (mountain-grown).	Shipment 466, tree No 48		.	. .	.	1.5 lbs per cu. ft.	Poor.	10	0	9[1] / 1[2]	1[1] / 9[2]	30
Total tori for mountain grown specimens			.	. . .	. . .	. . . .	. . . . .	88	2	117	33	240
Humboldt County, Cal. (lowland grown).	. . . .	. . . .	. . . . . .	. . . . . .	. . . . .	. . . .	Good.	29	1	0	26	56

[1] Summerwood did not take treatment
[2] Summerwood did take treatment.

up the mountain slope in the Snoqualmie National Forest, Washington, were examined. Both heartwood and sapwood material were examined whenever possible, and the results are shown in Table 2. The investigation disclosed a marked tendency, in both the heartwood and sapwood, toward the aspiration of the tori of the pits—that is, in both the springwood and summerwood the majority of the tori were displaced from the central position.

Oven-dry Material.—One specimen of coast or lowland-grown material oven-dried (bone dry) from the green condition was examined, and the results are given in Table 3. The general condition of displacement or aspiration of the tori noted in Table 2 was found here also.

THE POSITION OF THE TORI IN CREOSOTED DOUGLAS FIR WITH RELATION TO THE ABSORPTION AND PENETRATION OBTAINED

Green Material.—In the green coast or lowland-grown material, from western Washington, that had been treated with creosote the heartwood of four specimens was examined with results shown in Table 4.

It is to be noted that when the absorption and penetration were rated as good the majority of the summerwood tori were in the central position in the pit cavity.

Creosoted Air-dry Material.—The largest number of pits studied in one group (296) was in the creosoted air-dry material. One specimen of lowland-grown fir and nine specimens of mountain-grown were used. The results appear in Table 5. It is to be noted that the record of the mountain fir showed that the treatment obtained was uniformly poor. In fact, in the specimens studied, with one exception, no penetration beyond one cell (tracheid) length, about 1/6 inch along the grain, was noted.

The tori in the mountain-grown material in all these air-dry specimens showed a tendency to occupy positions other than the central one in the pit cavities.

In one mountain-grown specimen, Ship. 466, tree No. 48, a specially selected portion from near the surface of a piece of this material, which showed about ½ inch tangential penetration, was examined. Where the penetration had occurred in the summerwood, the great majority of the tori were in the central position in the pit cavity. In the majority of cases in mountain-grown material the treatment was poor or wholly lacking, and the tori were for the most part aspirated.

In the one specimen of lowland fir which was well creosoted, the great majority of the summerwood tori were centrally located.

TABLE 6.—*Positions of the Tori in Bordered Pits in Air-dry Douglas Fir Treated with Air Pressure Applied to End of Block.*

Source of material.	Description of specimen.	Treatment.	Location of Tori. Heartwood. Springwood. Asp.	Location of Tori. Heartwood. Springwood. Cen.	Location of Tori. Heartwood. Summerwood. Asp.	Location of Tori. Heartwood. Summerwood. Cen.	Total tori examined.
Missoula County, Mont. (mountain-grown).	Shipment 370, stick No. 11-23.	100 pounds air pressure applied; relieved every two or three minutes; again turned on suddenly; continued for 30 minutes.	10	0	8	2	20
		Air pressure gradually increased to 100 pounds; time of treatment, 30 minutes.	9	1	10	0	20
Total tori for mountain-grown specimens..........		....	19	1	18	2	40

In general the results obtained showed that good penetration and absorption accompanied a condition in which the majority of the tori were found in the central or unaspirated condition.

THE POSITIONS OF THE TORI IN BORDERED PITS OF DOUGLAS FIR AFTER THE MATERIAL WAS SUBJECTED TO VARIOUS ARTIFICIAL TREATMENTS

Air-dry Material Treated with Air.—Examinations were made on two specimens of mountain-grown material from Missoula County, Montana. Both specimens were heartwood and were treated with air. The pressure was applied to the end, or cross-section, of the block. The nature of the treatment and the results of the microscopic examinations of the pits after treatment are shown in Table 6.

Practically no difference was to be found here in the positions of the tori after the treatments and the positions they occupied in normal untreated air-dry wood of the same specimen, as shown in Table 2.

Steam-treated Material.—Three specimens of air-dry heartwood, mountain-grown material, from Missoula County, Montana, were given steam treatments. The specimens, which were small blocks about ½ by ½ by ⅝ inch in size, were placed in a closed cylinder and steam pressure applied. The results of the microscopic examinations made on the material after treatment are given in Table 7.

The positions of the tori were practically the same after these treatments as they were in the normal untreated air-dry material of the same specimen shown in Table 2.

Alcohol-soaked, Oven-dried Material.—A piece about ½ by ½ by 1 inch in size of coast or lowland-grown Douglas fir heartwood from Everett, Washington, was taken in the green condition and soaked for five days in each of a series of alcohols, 50, 95, and 100 per cent, respectively, and then oven-dried (bone dry) at a temperature of 200° F.

A microscopic examination of the positions of the tori in the outside of the block, where the penetration would be easiest and quickest, and also of the center of the block, where penetration would be more difficult and slower, gave the results incorporated in Table 8.

A comparison of the positions of the tori in a piece of the material in its green condition, as given in Table 1 with those in Table 8, shows that the tori are in the same position after treatment with alcohol and subsequent oven-drying as they were in the green specimen. In the oven-dry material, not treated with alcohol, from the same specimen, the majority of the tori in the summerwood were aspirated as shown in Table 3.

TABLE 7.—*Positions of the Tori in Bordered Pits in Douglas Fir After Treatment with Steam.*

Source of material.	Description of specimen.	Treatment.	Location of Tori.				Total tori examined.
			Heartwood.				
			Springwood.		Summerwood.		
			Asp.	Cen.	Asp.	Cen.	
Missoula County, Mont. (mountain-grown).	Shipment 370, stick No. H-23.	20 pounds steam pressure. Time, 30 minutes.	10	0	8	2	20
		Block placed in a beaker of water and the beaker put in steam-treating cylinder. Steam pressure of 20 pounds applied for 30 minutes; then increased to 40 pounds for 15 minutes.	10	0	10	0	20
		40 pounds steam pressure. Time, 15 minutes.	10	0	10	0	20
Total tori for mountain-grown specimens..........		....	30	0	28	2	60

TABLE 8.—*Positions of the Tori in Bordered Pits in Douglas Fir Treated with Alcohol and Oven-dried.*

Source of material.	Description of specimen.	Treatment.	Location of Tori. Heartwood. Springwood. Asp.	Springwood. Cen.	Summerwood. Asp.	Summerwood. Cen.	Total tori examined.
Everett, Wash. (lowland-grown).	Shipment 456, tie No. 15, outside of specimen.	Soaked in alcohol, then oven-dried.	10	0	0	10	20
	Shipment 456, tie No. 15, center of specimen.	Soaked in alcohol, then oven-dried.	10	0	1	9	20
Total tori for lowland grown specimens			20	0	1	19	40

CONCLUSIONS

1. A considerable number of the summerwood tori in both the sapwood and heartwood of the mountain-grown specimens of Douglas fir were already aspirated in the green wood. This was not true in the lowland specimens.

2. In the air-dry sapwood and heartwood of the mountain-grown material a still larger proportion of aspirated tori in both spring and summerwood were found (Table 2). In the air-dry heartwood of the lowland material (Table 5) aspirated tori were noted in the springwood, but in the summerwood the tori were all in the central position.

3. Oven-drying tended to increase the number of aspirated tori in both mountain and lowland specimens.

4. Creosoted specimens showed a fair to good penetration, especially in the summerwood in the lowland, but very poor or practically no penetration in the mountain-grown material. Lack of penetration coincided directly with the number of tori aspirated.

5. Treatments of air-dried material with air and steam caused no apparent displacement of the tori from the position held in matched untreated pieces from specimens.

6. Green lowland-grown material soaked in alcohol and then oven-dried showed the tori in the same positions after treatment that they held when the wood was in the green condition—that is, they did not become aspirated on drying, as did the tori in the specimens not treated with alcohol.

A SUGGESTED DEPARTURE IN NATIONAL FOREST STUMPAGE APPRAISALS

By Howard R. Flint

Forest Supervisor, Kaniksu National Forest

More or less real difficulty and dissatisfaction on both sides has followed in the wake of many conscientiously executed appraisals of National Forest timber. While a portion of this difficulty may have been due to inexperience or the lack of sufficient reliable data, it seems entirely probable that the greater part of it is an inevitable outcome of the method and cannot be eliminated by experience on the part of the appraiser, more complete data, or a more healthy condition of the lumber industry than at present exists.

Probably, under the present standardized methods, most appraisals are usually not far wide of the mark at the time they are made and are therefore quite readily accepted by purchasers. Where dissatisfaction arises later, it is often due to unforeseen fluctuations in price of labor or product which tend to invalidate the original appraisal.

It is with a view to calling attention to a factor which seems to have been largely overlooked, and with the hope of starting a discussion which may lead to the development of a more sound and equitable method of making appraisals in connection with large sales, that these suggestions are offered.

There can be no question but that the fundamental principle on which the value of National Forest stumpage is fixed is correct, as set forth in the instructions for making stumpage appraisals. This principle states that "stumpage will be regarded as worth the selling value of its product, less all costs of producing it, and a fair margin for profit to the operator."

There are three prime factors which enter into any appraisal based on the above-stated principle:

1. The actual selling value of the product.
2. An accurately determined cost of production.
3. A fair margin of profit.

Probably the greatest weakness in the existing method of making appraisals lies in the determination of the first factor. It is entirely true that a reasonably accurate figure can be determined for this value for any given time, but unless the appraiser be gifted with second sight

he cannot determine it until that time has passed, nor can a purchaser sell all of his product at any one time. The true selling value will be the combined receipts from all of the sales, made at different times and at varying prices, as a result of the operation, and the only possible time for its correct determination will be after the completion of the project.

Figures collected by the Western Pine Manufacturers' Association show that from the close of the last quarter of 1916 to the close of the last quarter of 1917 the selling price of the mill run of several species in the Spokane district varied from $17.49 to $26.92 per thousand, an advance of about 54 per cent, and during this period cost of production on a typical operation advanced only about 20 per cent. It is entirely conceivable that such a change in selling prices and costs may take place in any similar period, and that such a condition may continue for an indefinite length of time, that it may operate in either direction, that it may be nearly or quite independent of local cost of production, and that it may be wholly out of the control of either party to a National Forest timber-sale contract.

That such fluctuations do occur is known to all who through actual contact are familiar with the industry. A striking graphic illustration of unrelated fluctuations of this kind was published on page 34 of *American Lumberman* for March 9, 1918.

If these premises are sound, it is at once apparent that any appraisal based on a future selling value, determined from the history of the trade for the past year or period of years, may at any time become invalidated for a portion or all of the life of any given contract.

A remedy for this weakness in the appraisal would seem to lie in making the sale on the basis of current prices or average prices for a relatively short period, and requiring a bond in sufficient amount to cover any probable change in stumpage value that might occur from any or all causes during the life of the operation. The final and actual determination of the selling value might then be left until the close of the contract, with a refund of such portion of the bond and, if necessary, of the appraised price paid for stumpage as results actually warranted.

Of scarcely, if any, less weight in causing fluctuations in stumpage values is the cost of production. Like the preceding factor, this element can be determined with reasonable accuracy for a given operation at any particular time, but, as in the preceding case, the values may fluctuate with a wide range in a given locality during a brief period of time. In this factor, also, the fluctuations may be independent of any

fluctuation in the general market in which the output is sold; they may extend over a brief, or a very considerable, period of time; they may operate in either direction, and it may be quite impossible for any appraiser to foresee their direction or amount. A change in wages or working conditions in a widely separated region, sectional I. W. W. activities, and the sudden absorption of much of the available labor by some other rising local industry are causes which actually have had a material effect on cost of production in many cases. Doubtless it is true that in the course of time these temporary regional changes become adjusted to general market conditions, but this fact is scant comfort to the operator who must face an unwarranted stumpage price until such adjustment takes place.

A possibility of remedying this weakness in stumpage appraisals is at once apparent in the plan previously suggested for correcting the evil effects of unusual market conditions. To render this possibility applicable, logging-cost figures for use in appraisals should in all cases be expressed in terms of man-hours or horse-hours required for the performance by existing standard methods of each phase of the work under the particular given set of conditions. This plan of recording the cost of operations in hours might very well be applied, even in the current stumpage appraisal practice, since the unit of time is a value that does not fluctuate as does the purchasing power of money expended for wages, and the hour may very well be regarded as the absolute unit in which quantities of labor are marketed.

After expressing the cost of operating under any given set of conditions in hours, it may, for practical purposes, be translated into the English of the purchaser by expressing it in dollars and cents, reckoned at the average current rates of wages actually in effect in the region at the time.

All of the rules and safeguards applied to determining the cost of production under existing methods can be applied with equal facility to the proposed method, and the figure arrived at may then be accepted as the standard which an average operator may reasonably hope to attain. Whether or not the estimated number of hours or dollars is sufficient to do the work, the would-be purchaser must decide for himself, and on that decision, and his further decision as to whether or not the arbitrary allowance for profit is sufficient, he must submit or withhold his bid.

At the completion of the contract a final adjustment of stumpage prices may be made, based not upon estimates, but directly on the history of the industry during the life of the sale in question, both selling

value and labor costs being given proper weight in determining the amount of refund due the purchaser or the portion of the bond to be held fully to pay the Government. For the protection of the Government, contracts should provide that a certain small percentage of the deposits should be held as non-refundable in any event.

In determining selling values the actual average selling values for the region during the period in question should apply. Labor costs also should be determined not on the basis of actual expenditures by the individual purchaser, but rather on the basis of the standard number of hours fixed in the appraisal for performing the operation, multiplied into the average wage schedules of the region during the life of the contract. By this means will it be possible to avoid penalizing the unusually efficient operator and to encourage an effort to exceed the schedule and thereby realize an extra profit. If the operator is able to devise methods of logging cheaper than the standard practice of the time and region, or if he is able to apply his man-hours with more than ordinary effect, he is justly entitled to and will receive an increased profit as a result.

It is believed that it has been the experience of the Forest Service in the past that nearly all large sales are made at the appraised value, notwithstanding the fact that timber is auctioned to the highest bidder. That this condition will continue to obtain for some time to come now seems probable; but to meet the possibility of bids above the appraised price it will be advantageous, under the proposed method, to regard any premium offered by the purchaser as a bonus to be paid by him for the contract and retained by the Government, regardless of whether the appraised value is found to be low, excessive, or correct when the final adjustment is made.

The average wage schedules and selling values to apply should be the average obtaining for the region during the life of the sale, and to cover conditions of wide or rapid fluctuation it is probable that selling prices should be considered for a period of six months after the completion of operations on the sale, in order that the true selling value of all the manufactured product may be ascertained.

It will be noted that this plan does not contemplate the guarantee of any profit to the operator, nor does it undertake any assurance that the logging can actually be done in the estimated number of hours. It does aim to relieve the complaint that a Government stumpage contract is hide-bound and one-sided, and it is believed to offer some assurance to purchasers that stumpage rates will be based on actual existing rather than hypothetical unit values for labor and product.

It is, of course, obvious that the necessity does not exist for the application of any such methods to small sales of timber for local consumption or to any sale the contract period of which is of very short duration. That the need does exist for some method of making adjustments in large sales has long been recognized, although but feebly met by the provision in some of the larger contracts for periodic readjustments of stumpage rates. This plan contemplates making such adjustment as nearly correct as possible by rendering it continuously operative throughout the life of the contract.

One objection which may be raised to such a method is that in giving full weight in stumpage appraisals to market fluctuations we operate against the tendency that stable stumpage rates may have to reduce the cut automatically in periods of market depression. Since at the present time this desirable effect on the general timber market is much more a tendency than an accomplished fact, it is not of great importance until National Forest stumpage becomes a much larger factor in the timber market than it now is.

It has been suggested that where timber is sold on the basis of log grades it will also be necessary to establish by contract a percentage above or below the mill run for the region on which selling value of the product in any particular case will be based, since logs of better than average grade will cut out lumber that will bring more than average returns. This condition, however, can easily be met when the necessity of meeting it arises.

The question of interest due the purchaser on deposits refunded when final readjustment is made and of interest due the Government on payments deferred because of an appraisal made in a period of market depression is of some importance and it may be necessary to provide for its payment in either case. It is, however, regarded as of much less importance than the fact that an appraisal made under existing methods in a time of depression may lead to a loss to the Government not only of interest but of considerable principal as well.

Similarly, an appraisal based on the prices obtaining during a period of prosperity may lead to a substantial loss on the part of the purchaser.

It seems probable that provision for payment of interest at a moderate rate in such cases might be provided for in the contract. Interest on money deposited by the purchaser on account of co-operative brush-disposal agreements is now given consideration in existing approved stumpage appraisals, and while the case is not a parallel one it has something of similarity and appears to give satisfaction.

Possibly in the case of the Government, operating as it does over a long period of years, the gains and losses resulting from fluctuations would in a large measure be compensating and therefore of little consequence. This would be less true in the case of the individual operator, and particularly so with the relatively small operator belonging in the class it is the policy of the Forest Service to encourage.

The advantages claimed for this plan are:

1. It seems not so radical but that the present procedure may possibly be modified to include it, provided the advance payments for stumpage are regarded by contract as being deposits subject to a final readjustment.

2. It is relatively simple; therefore should not prove unduly difficult to present to prospective operators.

3. Nearly all of the data necessary for its application are now kept by either the operator, the Forest Service, or both.

4. Stumpage appraisals so made will not become invalid if not used for some time after their compilation, because they are based on a unit for labor cost that does not fluctuate as does the length of a day or the money price paid for time.

5. It will tend to promote sales by increasing confidence in Forest Service stumpage appraisals and eliminating one of the risks which now attends the purchase of National Forest timber.

Most of the arguments against such a plan may be quite as aptly applied to the method now in use, the greatest defect of which, it is believed, can be remedied by the use of the proposed method.

Comments on a Suggested Departure in National Forest Stumpage Appraisals

By James W. Girard

In the first part of the article the following statement is made: "The true selling value will be the combined receipts from all the sales made at different times and at varying prices as a result of the operation, and the only possible time for its correct determination will be after the completion of the project." Whether or not this is to be the basis for the readjustment in each individual case is not clearly brought out in the article.

If the readjustment in large sales is to be made on the history of that particular sale, assuming that it will show accurately the combined receipts from all of the sales made at different times throughout the life of the operation, I believe such a policy or practice would be very dangerous.

It would result, in my opinion, in considerable losses to the Government in many cases. It would tend toward overproduction and would encourage operators who might be good loggers but poor lumbermen to try the lumber game.

If an operator knew that the stumpage prices would be adjusted at the end of a sale on the actual history of the selling value of the product of that particular sale, there would be no incentive to the operator or particular reason why he should make any special effort to obtain the highest prices possible for the lumber. The only feature that he need be particularly interested in would be the estimated cost of operation or the output per hour per crew organization, as submitted by the Forest Service. It would be up to the purchaser to maintain the estimated output, but only this to protect his own interests. The quality of the manufactured product, the sales department, distribution, etc., which are without question the most important features of the lumbering game, need not seriously concern the operator if the readjustment is to be made on his actual sales, because he would make the same margin of profit if the mill-run value, through poor manufacture and poor salesmanship, only averaged $15 per thousand as he would if, through efficient management, the average was $20 per thousand. If the readjustment was to be made at the end of the operation on the average for a large region, the receipts for any particular sale would not be necessary. Readjustments would not be so objectionable on this basis, provided that the Government timber formed only a small percentage of the total cut.

The history of the lumber business in the United States during the past twenty years shows that if large sales of timber had been made on the basis of average lumber values for the last five years previous to the sale, the purchaser would be investing on a conservative basis.

Long-term sales are much more safe for the purchaser than short-term sales. If in the latter part of 1913 a chance requiring two years for its removal had been sold, based on the average lumber values for the preceding two years, it can be readily seen that the chances for loss would have been much greater than in the sale of a chance sufficiently large to require four years for its removal.

In my opinion, our present form of contract is based upon sound, logical principles, so far as it goes, but is probably too much one-sided to be entirely equitable to both Government and purchaser in certain cases. A readjustment clause, worked about as follows, would be entirely satisfactory:

It is agreed that the stumpage shall be readjusted at the end of each four-year period. If the average price of any species prevailing during any four-year period shows an increase over the prices of the same species as agreed upon at the date of execution of the contract of $2 per thousand feet board measure or less, no increase shall be made in the stumpage rate specified in the contract. If the increase in the average price of any species is greater than $2 per thousand feet board measure during the four-year period, not more than 75 per cent of the amount of such increase in excess of $2 will be added to the stumpage rate fixed in the contract.

It is further agreed that, if the average price of any species prevailing during any readjustment period declines $2 per thousand feet board measure or less, no reduction will be made in the stumpage value as specified in the agreement. If, however, the average price of any species during any readjustment period is more than $2 per thousand feet board measure less than the price specified in the contract, not more than 75 per cent of the amount of such decrease in excess of $2 per thousand feet board measure will be subtracted from the stumpage rate fixed in the contract.

I am somewhat skeptical about the advisability of basing the readjustment of stumpage values upon a consideration of the wage scale prevailing during the readjustment period without the Government determining what the wage scale should be, because this would place the lumberman in a position where he could overbid all other industries for labor at the expense of the Forest Service.

Mr. Flint further states that the fundamental principle on which the value of National Forest stumpage is fixed is correct, as set forth in the Instructions for Making Stumpage Appraisals. It is true that the appraisal manual provides that "stumpage will be regarded as worth the selling value of its product, less all costs of producing it, and a fair margin for profit to the operator." I do not believe that this statement should be in the appraisal manual in its present form, because it is misleading and it is not the principle upon which stumpage values are based. Stumpage values in large sales are based upon the history of the selling value of the finished product for a period of three to five years, as the case may be. Of course, the quality of the timber for sale is considered and the average selling value over a given period is increased or decreased accordingly as the quality of the timber under consideration may justify. We take the history of the lumber business over a period of from three to five years and say to the prospective purchaser: This is the basis upon which we are willing to sell; are you willing to purchase on this basis? It may be that the amount of money represented by the stumpage varies from 50 cents to $3.50 per thousand, with an average of $2 per thousand. It seems to me that if the purchaser is willing to invest from $12 to $15 per thousand in addition

to the stumpage, on the basis of past results, there is no reason why we should not be willing to sell on the same basis. The actual selling value of the product from any given tract of timber offered for sale has nothing to do with the basis upon which stumpage prices were fixed. The stumpage values are fixed upon the actual selling value of similar products during a period of from three to four years previous to the sale. It is assumed by both the Government and the purchaser that the actual values during a certain period in the past are a sufficiently accurate index of the future to be used as a basis upon which the value of certain products may be fixed and business transactions consummated. This is the fundamental principle upon which the sale value of mines, agricultural lands, and all other money-earning industries, commodities, or business enterprises is based. This basis of determining values involves a certain amount of risk, not only in timber sales, but in all other lines of business, because of the market fluctuations from time to time in the commodity produced. The risk, however, involved in any business enterprise or industrial undertaking is largely the father of efficiency and the foundation of progress.

TURPENTINE ORCHARDING EFFECT ON LONGLEAF TIMBER

By George Drolet

Forester, Kaul Lumber Co., Tuscaloosa, Ala.

The large timber-holders of the South associate the naval store industry in their minds with the destruction of the virgin longleaf pine forest that once extended from Virginia to Texas. It is unfortunate, indeed, that the turpentine operator should have earned for himself such a reputation. The present-day operators have inherited the sins of their fathers, and are looked upon with distrust by the holders of the remaining virgin longleaf pine. This attitude is crippling a worthy industry.

The timberland owner, particularly if he is a sawmill operator, can realize a handsome income from his timber in the sale of turpentine privileges, and if he uses proper management can do so without endngering his output of lumber. The Kaul Lumber Company have been cutting their longleaf pine timber for some years without previous turpentining. They had made an unsuccessful attempt at turpentining in the past and had decided that it was poor business to mix the two industries. Under this policy the applications of timberless turpentine operators were turned down as fast as received, until finally there came a certain persistent operator who persuaded the company to allow him to work the timber for turpentine under the following plan: At the beginning of each season the operator would cup ten crops of virgin timber, each crop to be worked for two seasons only. The areas to be turpentined are those in which logging would follow immediately after the second season of turpentining.

The following paragraphs (A to D) show the effect of turpentining under different conditions. The territory covered by Paragraph A was selected a year in advance of the logging and each healthy tree 12 inches and up tapped. One face only was allowed on trees 12 inches to 16 inches in diameter, inclusive. On trees 17 inches and up two cups were placed, and no more than two cups were allowed on any tree. Trees showing large scars on the butt received only one face. Cupping was done with the idea of protecting the timber above all. The cupping was started in the winter of 1916. Paragraph A shows the result of an examination of the areas in December, 1916, the end of the first season.

A.—Acres under turpentine, 1,984; acres counted, 382; affected trees on total acreage, 36.4; total scale of affected trees on entire acreage turpentined, 21,389 feet; affected trees to the acre (average), .0183; per cent of entire stand affected, .117.

It is to be noted that the damage from the turpentining is negligible. This is not at all remarkable, since the timber had not been worked enough to develop the full injuries received. This area was cut over during the following spring and summer. In examining the timber a 20 per cent strip system was used, and all dead or dying trees were noted. In determining the cause of the death of cupped trees, the careful examination of each individual tree was necessary. There are many causes that conspire to injure green timber besides the injury from tapping. Ordinary decay accounts for the death of many trees each year in a forest so matured as this one. Lightning also takes a heavy toll, both directly and indirectly, for each tree killed by lightning serves as an incubator for hordes of timber-borers. Some old decaying trees fall a victim to the assault of the chipper after various periods of resistance. In many cases such trees are a distinct gain, as their lumber value would have been nil even had they lived.

At the beginning of the season of 1917, 6,299 acres of virgin timber were cupped. An examination of the acreage at the end of the season showed the following results:

B.—Total acreage under turpentine, 6,299; acres counted, 825; affected trees, 16; affected trees to acre, .0222; number on total acreage, 138.57; average merchantable contents of each affected tree, 318; average log scale of affected trees, 6.996; total log scale affected on entire acreage turpentined, 44,067 feet; per cent of entire stand affected, .00061.

During the season of 1918 our plan for dropping part of the turpentine area for the loggers and tapping the balance for another season went into effect. At this time the labor problem became very acute and the progress of the work was greatly reduced. However, we were able to hang aprons in the new territory up to the original requirements of our program. An examination at the end of the first season gave the following results:

C.—Total acreage turpentined, 3,999; acres counted, 626; affected trees, 32; scale of trees after reduction of defects, 17,418 feet; number of trees affected to acre (average), .051; number of affected trees on total acreage, 203; average merchantable contents of each affected tree, 544 feet; average log scale per acre of affected trees, 28 feet; total log scale affected on entire acreage turpentined, 110,432 feet; per cent of entire stand affected, .0032.

It will be noted that the two-year working was considerably more damaging than the one-year operation. This is natural and to be expected. Under our arrangement the timber will be logged at once and will not represent a loss.

D.—Total acreage turpentined, 520; acres counted, 68; affected trees, 3; scale of trees after reduction of defects, 1,626 feet; number of trees affected to acre (average), .043; number of affected trees on total acreage, 22; average merchantable contents of each affected tree, 541 feet; average log scale per acre of affected trees, 22 feet; total log scale affected on entire acreage turpentined, 11,902 feet; per cent of entire stand affected, .0021.

In Paragraph D a higher rate of damage is shown for this timber than for the other timber, which was worked for one year. This is due in large measures to improper selections of trees to be cupped and to inefficient and inexperienced laborers.

We make a strong effort to reduce the fire damage which is attendant on firing the woods at the time the cups are hung. Burning the litter on the forest ground at any time invariably causes a partial or total destruction of trees scarred near the stump. These trees are prevalent in every pine region located anywhere near farming communities. The farmers have no scruples whatsoever about hacking into trees in order to test the grain of the trees for shingles and boards, and such trees are of the finest in our forests, and to allow them to be burned is to cause a considerable loss of valuable timber. While it is considered necessary to burn the litter on the forest floor as a part of the turpentining operation, it is essential that this phase of the business be closely controlled and supervised by the owners of the timber.

AN ANALYSIS OF LOGGING COSTS IN ONTARIO

COMPILED BY G. A. MULLOY AND W. M. ROBERTSON

It is customary for students in the Faculty of Forestry in the University of Toronto to visit a logging camp during the Christmas vacation and report upon a prescribed schedule the operation under observation, including costs, etc.

The following data have been compiled from a large number of these reports, supplemented and checked by data of the compilers. They represent averages for the Province of Ontario and may be of interest, especially on account of their completeness and arrangement.

Camp Equipment

Blacksmith outfit	$200.00		
Kitchen stoves and cooking outfit	300.00		
Other stoves	60.00		
Blankets, 150 pairs	450.00		
Stationery and office fittings	100.00		
		$1,110.00	

General Equipment

12 teams at $450 each	$5,400.00		
12 sets harness at $45	540.00		
12 pairs double-trees at $3.50 each	42.00		
10 cross-cut saws at $4.75	47.50		
2 dozen d. b. axes at $12 per dozen	24.00		
3 dozen s. b. axes at $8 per dozen	24.00		
5 dozen handles at 25 cents each	15.00		
500 feet decking line, $15 per 100 feet	75.00		
½ dozen blocks at $1.75 each	10.50		
3½ dozen cant-hooks at $15 per dozen	52.50		
6 pairs wedges at 25 cents a pair	1.50		
1 dozen sledge-hammers, 3 pounds, $6 per dozen	6.00		
2 grindstones	5.00		
1 dozen shovels	9.00		
1 sprinkler	75.00		
12 hauling sleds made in camp, $60 each	720.00		
		7,047.00	
			$8,157.00

Depreciation charged to each project with exception of camp equipment.

Improvements:

Camps for 100 men	$2,000.00	
Building 6 miles tote road at $300 per mile	1,800.00	
		3,800.00
		$11,957.00

One-half charged each year—cost per M on 3,750 M = $25.

Interest at 6 per cent for one year	$717.42	
Interest on investment per M	.19	

Administration

1 foreman at $75 per month, 8 months	$600.00	
1 scaler, half time, at $60 per month, 3 months	90.00	
1 blacksmith at $60 per month, 5 months	300.00	
1 clerk—half time at $60 per month, 6 months, or full time at $30 per month	180.00	
1 handy man at $30 per month, 6 months	180.00	
1 barn boss at $28, 5 months	140.00	
1 choreboy at $26, 6 months	156.00	
Board for above	675.00	
Total		$2,321.00
On cut of 3,750 M board feet, cost per M		.62

Cutting Costs—1 Day

1 fitter at $32 per month, plus board at 60 cents per day	$1.80	
2 sawyers at $30 per month, plus board at 60 cents per day	3.50	
1/10 filer at $30 per month, plus board at 60 cents per day	.12	
Files	.05	
Depreciation of tools	.08	
Total		4.55
Cost per M feet b. m. (100 logs per day, 19 logs per M, or 5,000 bd. ft. per day)		.91

(Cost reported as $1.10 in several cases.)

Skidding Costs—1 Day

4 swampers at $26 per month, plus board at 60 cents per day	$6.40	
2 teamsters at $30 per month, plus board at 60 cents per day	3.52	
1 roller at $30 per month, plus board at 60 cents per day	1.16	
1 decker at $32 per month, plus board at 60 cents per day	1.83	
2 teams, feed at $1 per team per day	2.00	
Depreciation, 50 cents	1.00	
Depreciation, 2 sets harness, 7½ cents per set	.15	
Depreciation, tools	.20	
Total		16.26
This crew would probably keep 1½ crews of log-makers busy, so would skid 150 logs a day, or 7 to 8 M board feet.		
Cost per M for skidding		2.17

(Cost reported, $1.80 to $2.50.)

Cost of Constructing Haul Road—6 Miles for Season

2 teams for 2 months, feed at $1 per team per day	$120.00	
Depreciation, 50 cents per team per day	60.00	

2 teamsters for 2 months, \$30 a month, plus board at 60 cents per day	182.40	
2 sets harness, depreciation for 2 months	9.00	
1 road boss for 2 months, \$32, plus board at 60 cents per day	100.00	
7 men for 2 months, \$26 a month, plus board at 60 cents per day	616.00	
Depreciation of tools	5.00	
Total		1,092.40
For cut of 3,750 M, cost per M for constructing haul roads		.29

Cost of Haul Road—Breaking, Surfacing, and Maintenance for Season

1 team for 2½ months, feed at \$1 per team per day	\$75.00	
Depreciation, 50 cents per team per day	37.50	
1 teamster for 2½ months, \$30 a month, plus board at 60 cents per day	120.00	
1 set of harness, depreciation for 2½ months at 7½ cents per day	3.75	
Snow-plow, tools, etc., depreciation	34.25	
1 road boss at \$32 a month, plus board at 60 cents per day	125.00	
7 men at \$26 a month, plus board at 60 cents per day	770.00	
Total		1,095.50

Maximum road in use at one time, 3½ miles.

For cut of 3,750 M, cost per M		.29

Cost of Loading—1 Day

2 senders at \$30 a month, plus board at 60 cents per day	\$3.50	
1 top loader at \$32 a month, plus board at 60 cents per day	1.83	
1 teamster at \$30 a month, plus board at 60 cents per day	1.83	
1 team—depreciation, 50 cents per team	.50	
Feed, \$1 per team	1.00	
1 set harness—depreciation, 7½ cents	.08	
Tools, depreciation	.20	
Total		8.94

Basis, 3½-mile haul, 2½ round trips, with 3 M a load, 3 teams, or 35-40 M board feet.

Cost per M for loading		.39

Cost of Hauling (on Basis above)—1 Day

1 teamster at \$30 per month, plus board at 60 cents per day	\$1.75	
1 team—depreciation, 50 cents per team per day	.50	
Feed, \$1 per team	1.00	
1 set harness, depreciation, 7½ cents	.08	
Sleighs, depreciation	.30	
Total		3.63
Cost per M for hauling		.50

Cost of Unloading per M (see Text)

2 men at $30 per month, plus board at 60 cents per day (can unload 27 M per day).

Cost per M for unloading	.13

Total Costs per M

Improvements	$0.25	
Interest on investment in equipment	.19	
Administration	.62	
Cutting	.91	
Skidding	2.17	
Road and skidway construction	.29	
Road breaking, surfacing, and maintenance	.29	
Loading	.39	
Hauling	.50	
Unloading	.13	
Scaling	.04	
Total		5.78

Below we give actual total cost data from various camps and years:

Year	Cost
1906	$5.50
1908	7.95
1909	6.02
1911	7.10

From these figures it will be seen that our estimate is, if anything, conservative.

A VOLUME TABLE FOR HEWED RAILROAD TIES

By James W. Girard and U. S. Swartz

The United States Railroad Administration has changed the specifications for cross-ties. Formerly the railroads had (as a rule) two grades of ties; the new rules specify five grades, which, for hewed ties, must conform (within certain margins) to the following measurements:

No. 1. 6″ x 6″ x 8′
No. 2. 6″ x 7″ x 8′
No. 3. 7″ x 7″ x 8′
No. 4. 7″ x 8″ x 8′
No. 5. 7″ x 9″ x 8′

The substitution of five grades for two complicated the problem of appraising the stumpage. With only two grades, it was comparatively simple to arrive at a stumpage price for each grade or to establish a flat rate. With five different grades to consider, however, and a different selling price for each grade, arriving at a stumpage price became much more difficult. It was clearly impracticable to figure the costs of logging separately for each grade, and consequently the fixing of a stumpage price for each individual class was not feasible. Such a plan had the further disadvantage that the Government was unable to settle with the purchaser until after an inspection of the ties had been made at the railroad.

A flat rate has many advantages from the Forest Service standpoint and is entirely feasible, provided it is possible to determine the percentage of the various grades of ties which any given tract of timber will produce. It was obviously impossible for any cruiser to determine accurately these percentage figures without the assistance of a table based on careful measurements. The use of such a table in determining a flat stumpage rate was premised on and supported by the policy established for the Montana District of the U. S. Forest Service, to make no tie sales where the purchaser was unable or unwilling to utilize the entire contents of every tree cut for ties of any grade permitted by the specifications. In other words, the district refused to recognize any limitation upon the number of low-grade ties to be sold, except that imposed by the form and size of the trees in the stand.

A tie volume table was constructed by the writers to show the number of ties to be obtained from each diameter and height class. Sufficient trees were cut to make between 900 and 1,000 ties, and from the measurements obtained the following table was prepared:

Volume Table for Railroad Ties—Larch and Douglas Fir (Kootenai, Cabinet, and Pend Oreille National Forests), Showing the Number of Each Class of Ties per Tree from 12 to 16 inches d. b. h., Inclusive

For sawed or hewed ties.		Tie classes.				
D. B. H.	Ties per tree.	No. 1	No. 2.	No. 3.	No. 4.	No. 5.
12	2	2	..	..	..	..
	3	2	1	..	..	..
	4	2	2	..	..	..
	5	2	2	1	..	..
	6	3	2	1	..	..
13	2	1	1	..	..	..
	3	2	0	1	..	..
	4	2	1	1	..	..
	5	2	1	2	..	..
	6	1	2	2	..	..
	7	1	2	2	2	..
14	4	1	2	1	..	..
	5	1	2	2	..	..
	6	1	2	2	1	..
	7	1	2	2	2	..
	8	1	2	3	2	..
	9	1	2	3	2	1
15	3	1	1	1	..	..
	4	1	2	1	..	..
	5	1	2	1	1	..
	6	1	2	1	1	1
	7	1	2	1	2	1
	8	1	2	1	2	2
	9	1	1	2	2	3
16	6	1	1	2	1	1
	7	1	1	2	1	2
	8	1	1	2	1	3
	9	1	1	1	2	4
	10	1	1	1	2	5

There is a slight difference in the form factor for larch and Douglas fir in tie-size trees, but the difference is not sufficient to affect the grades of ties to be obtained from trees of the same diameter and height class.

Most of the trees measured were larch, but sufficient Douglas-fir measurements were obtained to be sure that the results would be applicable to both species.

The usual measurements were taken. Stumps were cut 14 inches high and the trees measured at d. b. h. and inside the bark at 8-foot intervals to the nearest 1/10 inch. The length of the piece wasted in the top as compared to the utilization obtained in a sawlog operation (8 inches in the top) was also recorded.

The trees were separated into diameter and height classes; for example, all trees between 12.6″ and 13.5″ were classed as 13″ trees.

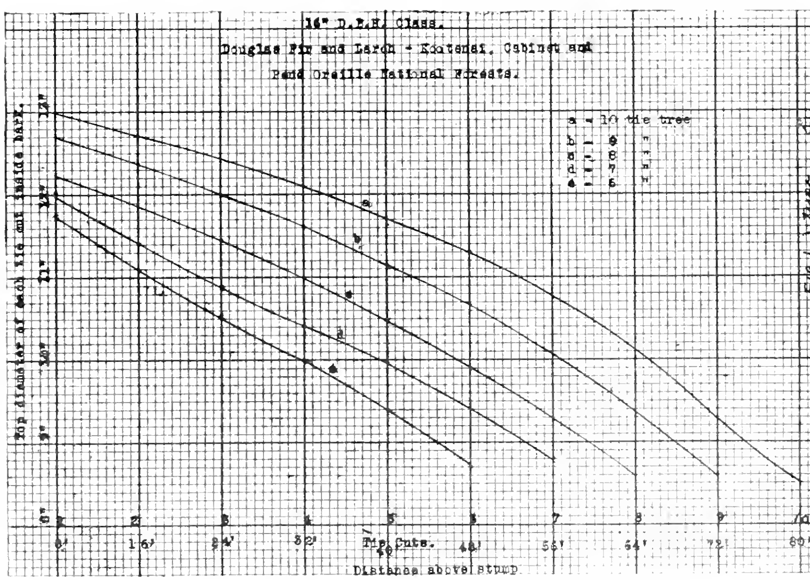

FIG. 1.

Mathematical means, smoothed out by curves, were used to build up the tie table. The minimum top diameter of the pieces required to make the various grades of ties were determined to be as follows, beginning with grade No. 1, 8.5″, 9.2″, 9.9″, 10.6″, and 11.4″. The curves (fig. 1) for the 16-inch d. b. h. class will illustrate the method used in arriving at the figures for the volume table.

Several satisfactory checks have been obtained by comparison of the percentage of ties cut from certain stands as determined by the railroad inspection and the estimated percentage as determined by the use of the

table. The actual weighted selling value per tie has varied from the estimated value from 1/4 to 1 cent.

The percentage of waste as determined by the measurements compared to sawlog utilization varies from 2 to 33 per cent, and shows that the waste is above 20 per cent in any tree which will not produce at least four ties.

It is planned to construct at a later date a table for sawed ties only, showing the tie contents for trees of larger diameter and height classes.

REVIEWS

History of Prices during the War: International Price Comparisons. By Wesley C. Mitchell, assisted by Margaret L. Goldsmith and Florence K. Middaugh. Division of Planning and Statistics, War Industries Board, in co-operation with Department of Commerce. Government Printing Office, Washington, 1919. Pp. XIII + 395.

"International Price Comparisons," one of a series of bulletins prepared by the War Industries Board on the history of price fluctuations during the war, gives the wholesale prices from January, 1913, to December, 1918, by months, quarters, and years, of 491 series of commodities (not allowing for duplication). For each commodity are given the quotations in foreign units and currency and corresponding quotations of the closest American equivalent article in American units and currency. There are also given for each commodity the relative prices, based on a scale of 100, equal to the average price in the respective countries for the twelve months July, 1913, to June, 1914.

The relative prices of different commodities covered for each country are averaged by using median prices, to form index numbers of the general price levels of the country. The countries covered (compared in each case with the same or equivalent commodities in the United States) are: United Kingdom (150 articles), France (44), Italy (36), Japan (36), Russia (23), Australia (66), India (24), Germany (30), Austria (14), Denmark (17), Norway (18), Sweden (12), Argentina (21). Price movements in Canada and the United States are compared by means of index numbers. For some of the countries (Germany, Austria, Italy, Russia, Denmark, Norway, India) figures for the last two or three years are lacking.

"The outstanding fact established by the . . . tables is that the extraordinary rise of prices which started in Europe on the outbreak of the war spread over the whole commercial world. Remoteness from the chief scene of conflict did not protect Japan or Australia from a revolution in prices; difference of economic organization did not protect India; the maintenance of neutrality did not protect Argentina. No other development has ever demonstrated so forcibly the strength of the economic bonds that unite all the nations of the globe in a common fortune.

"The American price fluctuations were distinctly less violent than

the fluctuations in England, not to speak of the belligerents and neutrals in Europe. In Canada also the price line was higher than in the United States, except for the first few months of American participation in the war. Australian prices stood higher than ours in 1914-16, but lower in 1917-18. Japanese prices, on the contrary, lagged behind American prices until July, 1918, when they seem to have taken the lead. Of the 14 countries studied there are only 2 in which the level of prices was all the time less than in the United States—India, for which the quotations end with 1917, and Argentina, with which the comparison extends to August, 1918."

Of especial interest to foresters are the quotations for lumber and other forest products. They unfortunately are too few in number and are given for too few countries to give a very complete picture of what happened to prices of this group of commodities. Moreover, of the 21 series of commodities only seven represent lumber and one shingles. They do indicate, however, in a general way, the effect of the war on these prices. The commodities for which comparative data are given are:

ENGLAND

1. Lumber, Danzig and Memel, at London-Manchester.
2. Logwood, Campeche, at London.
3. Turpentine, American, at London.
4. Wood pulp, chemical, soda, unbleached, at London.
5. Wood pulp, chemical, sulphite, bleached, at London and Manchester.
6. Wood pulp, mechanical, 50 per cent moist, at London and Manchester.
7. Acetone, at Manchester.
8. Acetic acid, 60 per cent, at Manchester.
9. Acetate of lime, gray, 80 per cent, at Manchester.
10. Shellac, T. N., orange, fair, at London.
11. Fustic, Jamaica, at London.

UNITED STATES

1. Lumber, pine, at Boston.
2. Logwood, sticks, at New York.
3. Turpentine, at Savannah.
4. Wood pulp, chemical, soda, at New York.
5. Wood pulp, chemical, sulphite, bleached, at New York.
6. Wood pulp, ground, at New York.
7. Acetone, at New York.
8. Acetic acid, 28 per cent, at New York.
9. Acetate of lime, New York.
10. Shellac, at New York.
11. Fustic, sticks, at New York.

ITALY

1. Pine, boards, at Naples.
2. Pine, squared, at Naples.
3. Pine, pitch, boards, at Genoa.
4. Pine, pitch, beams, at Genoa.

UNITED STATES

1. No. 1 common S-2-s, 1 x 10, at Arkansas.
2. Timbers, S-1-s-1-E, 6 x 8 x 16, at Mississippi.
3. No. 1 common, S-2-s, 1 x 10, at Arkansas.
4. Timbers, S-1-s-1-E, 6 x 8 x 16, at Mississippi.

AUSTRALIA	UNITED STATES
1. Pine, Baltic red, flooring, 6 x 1⅛, at Melbourne.	1. Pine, N. C., flooring No. 2, 1 x 4 x 10-16, at mills.
2. Resin, G grade, at Melbourne.	2. Resin, common to good, strained, at New York.
3. Turpentine, at Sydney.	3. Turpentine, spirits, at Savannah.

JAPAN	UNITED STATES
1. Pine, boards, 6 bu (¾″), Sendai, common, at Yokohama.	1. White pine, boards, at New York.
2. Shingles, Teshu, common, at Yokohama.	2. Shingles, red cedar, at Washington State.
3. Paper, Hanshi, Sugizaka, medium, at Yokohama.	3. Paper, newsprint, at mills.

In addition, Japanese prices are given for several kinds of boards, logs, and timber, and for railroad ties, charcoal, and firewood, for which there are no equivalent American quotations. Prices of teakwood in India are also given.

The most striking fact brought out by the figures is that the levels reached by American prices were far below those reached in the other countries (except for logwood, fustic, and acetone, which went higher in the United States than in England, and resin, which was lower in Australia than in the United States). Moreover, the divergence between foreign and American levels for forest products was in all cases greater than the divergence for all products grouped together.

Maximum divergences in level during the 19 months before the war and during the period from August, 1914, to December, 1918, were:

(Plus (+) sign indicates price-level lower in United States; minus (—) sign, higher in United States.)

UNITED KINGDOM

	Before war.	Since August, 1914.	
Pine lumber	+ 17	+ 260	March, 1917.
Logwood	0	—267	May, 1916.
Turpentine	± 7	+ 314	April, 1917.
Soda pulp	— 5	+392	May, 1917.
Sulphite pulp	+ 5	+314	July, 1917.
Ground pulp	+ 12	+ 506	July, 1917.
Acetone	+ 8	+ 140	October and November, 1916.
Acetic acid	+ 12	+ 414	September to December, 1918.
Acetate of lime	± 12	+ 235	April to December, 1918.
Shellac	— 9	+243	March, 1918.
Fustic	0	— 146	October, 1917.

ITALY

Pine boards	+ 6	+ 164	April to June, 1916.
Pine timbers	— 17	+ 88	February, 1915.
Pitch-pine boards	— 5	+ 237	December, 1916.
Pitch-pine timbers	— 10	+1,063	November, 1918.

(Except for last item, no data after 1916.)

JAPAN

	Before war	Since August, 1914	
Pine boards	−9	+70	March, 1918.
Shingles	−30	+61	October, 1918.
Newsprint	+18	+92	August, 1918.

AUSTRALIA

Pine flooring	−15	+69	October to December, 1917.
Resin	−43	+80	June, 1915.[1]
Turpentine	+15	+103	April, 1918.

In England pine lumber was depressed in price from the summer of 1913 to early in 1915, when it made a sharp rise. Another rise occurred in the spring of 1916, and a final one in March, 1917. The price was stationary after that, probably because of government control. Logwood rose from the latter part of 1915 to the summer of 1916, and again in the summer and fall of 1917. Fustic rose at intervals from December, 1917, to the end of the war. Its sharpest rise was in July, 1916, and was immediately followed by the only fall in price which occurred in the four years. Turpentine rose at the outbreak of the war, fell back almost to the pre-war level early in 1915, rose again sharply the next winter, fell, rose in the fall and winter 1916-17, and extremely rapidly in the last months of 1917, since when it has fallen off a little. Ground pulp rose gradually from the beginning of the war, with a rapid rise early in 1916, followed by a setback. When the United States entered the war it shot up very rapidly. A quick reaction followed in the fall of 1917, but another rise came during the winter 1917-18 and the following spring. Soda pulp followed a similar course, except that the 1916 rise was greater than that in 1917, and the trend in the last part of 1918 was downward instead of stationary. Sulphite pulp rose in September, 1914, but fell back until the fall of 1915, when it commenced to rise very rapidly. In the middle of 1916-17 it fell slightly, but rose again to its maximum height in the early summer of 1917. It fell again in the fall, but rose during the winter, and since the spring of 1918 has been declining. Acetone, which had been declining since January, 1913, rose rapidly from August to September, 1914; in July, 1915; from January to April, 1916; fell sharply in December, 1916, and January, 1917; rose again at the end of 1917 and was tending downward at the end of 1918. Acetate of lime fell until July, 1914, and did not begin to rise rapidly until the following January, after which it rose very steadily until the summer of 1916. A period of falling prices followed until the middle of 1917,

[1] Resin margin probably greater in negative direction after July, 1918; Australian prices lacking after that month.

after which another sharp rise occurred (in August), and the price then reached was maintained until the end of 1918. Acetic acid rose slightly when the war started, but fell back later and began its "sky-rocketing" in the spring of 1915 and continued it until June of the next year. During the next six months its price fell back to less than half of that in June; then started to climb again, especially in April, 1917, until it reached its maximum price in August, 1918. Shellac declined in price from the summer of 1913 to that of 1915, since when it rose fairly steadily and rapidly until March, 1918. It has tended downward since.

In Italy, pine lumber rose sharply from October, 1914, to February, 1916, after which it remained stationary for the remainder of the year. (Later figures are lacking except for longleaf (pitch pine) timbers.) Pine timber rose from October, 1914, to December, 1915, except for a sharp drop in March, 1915. Pitch-pine lumber did not begin to rise much above peace-time levels until the summer of 1915. Since then, up to the end of 1916, when the figures leave off, its rise was rapid. Longleaf timber began to go up at about the same time and was still rising rapidly at the close of 1918 (1917 quotations are missing). The level reached, 1,241 per cent of the base price, was the highest reached by any of the forest products in any of the countries studied.

In Japan there was a general depression in prices of lumber and other forest products, especially after the outbreak of the war, up to the middle of 1916. Then followed a more or less erratic gradual rise to the middle of 1917, when came a period of rapid rises, especially in July to August and November to December, 1917. The rise was checked for lumber items in March and April, 1918, but charcoal and firewood seemed to be still rising at the end of the year. Paper rose late in 1915 and early in 1916, fell back almost to pre-war levels, and made its greatest rise after the middle of 1917. The tendency was sharply upward when the figures closed, in October, 1918.

In Australia, pine prices began to rise early in 1915 and continued until the end of 1917. Another rise was started at the end of 1918. These rises were less rapid and did not reach as high levels as in the other countries studied, excepting the United States. Turpentine and resin followed rather erratic up-and-down courses, with rises in the summer of 1914, spring of 1915, winter of 1915-16, most of 1917, and summer of 1918.

In the United States, southern pine, which was low in price up to September, 1915, rose slowly up to April, 1917, when prices rose sharply and continued to rise until early in 1918. White pine rose in

January, 1917, and continued to rise until July, 1918. Shingles rose in the winter of 1916-17, fell from the spring of 1917 to early in 1918, when they rose again only to fall since the middle of the year. Ground wood pulp was low up to the fall of 1916, when it rose for a short period. When the United States went into the war it fell off rather rapidly to July, 1918, since when the tendency has been slightly upward. Soda pulp made its most rapid rise in the spring of 1916, continued to rise until we entered the war, then fell to the end of 1917, and was practically stationary in 1918. Sulphite pulp rose rapidly from the spring of 1916 to early in 1917, then fell until the spring of 1918, since when it rose again, especially in August and September. Logwood rose most rapidly between February and May, 1916, after which the price fell back almost to its starting point by October; then rose, with more or less fluctuation, until the end of the war. Fustic rose in September, 1914, kept that level for a year, then rose at intervals until May, 1916, after which it was again stationary for sixteen months. It made a sudden spurt in October, 1917, fell back, and rose again in the summer of 1918. Resin declined in price until October, 1915, when it rose sharply until December, fell again, rose in June, 1916, and, after considerable fluctuation, began in May, 1918, a period of extremely rapid rise, which was maintained until November. Turpentine followed an erratic course, with rises in the winters of 1913-14, 1915-16, 1916-17, fall of 1917, and last half of 1918, but did not reach very high levels at any time. Shellac price paralleled the English price very closely until June, 1917, when it declined for five months; then rose until November, 1918. Acetone followed somewhat the same course as in England, although not quite at the same times. Its period of most rapid rise began in December, 1914, and continued with one or two short interruptions until March, 1916. The price then fell sharply until the end of 1916, rose during 1917, and has fallen since March, 1918. Acetate of lime followed almost exactly the same course in the United States and England, except that the fall in price late in 1916 started a month sooner in the United States and went to a much lower level. Its recovery during 1917 was spread over a longer period, did not reach as high a point as in England, and it fell off again in April, 1918, while the English price remained stationary. Acetic acid also followed very similar courses in the two countries, except for a few months later start in the United States, a somewhat earlier decline in 1916, and a later rise in 1917. In the United States there was also a low period in the winter of 1917-18 and a sharp fall beginning in July, 1918, which had no counterpart in the English curve.

The highest prices reached by the different commodities are shown in the following table. The numbers represent prices as compared with the assumed basis of 100, the average price from July, 1913, to June, 1914:

Highest Price Levels, 1913-1918

	United Kingdom		United States	
Pine lumber	368	Mar., 1917, to Dec., 1918.	137	July to Dec., 1918.
Logwood	250	Nov., 1917, to Dec., 1918.	467	May, 1916.
Fustic	429	Sept., 1918, to Dec., 1918.	500	Sept., 1918.
Turpentine	407	Jan., 1918.	156	Nov. to Dec., 1918.
Shellac	551	Mar., 1918.	355	Sept. to Nov., 1918.
Soda pulp	654	April to June, 1917.	273	Mar., 1917.
Sulphite pulp	526	May to July, 1917.	284	Feb., 1917.
Ground pulp	695	June and July, 1917.	222	Mar., 1917.
Acetone	322	Apr. to Aug., 1916.	347	Mar. and Apr., 1916.
Acetic acid	701	Aug. to Dec., 1918.	585	June, 1918.
Acetate of lime	444	Aug., 1917, to Dec., 1918.	365	Feb. to Aug., 1916.
	Australia			
Pine flooring	238	Dec., 1918.	173	Apr. to June, 1918.
Resin	244	July, 1918.	387	Nov., 1918.
Turpentine	198	July, 1918.	156	Nov. and Dec., 1918.
	Italy			
Pine boards	288	Feb., 1916.	213	July to Dec., 1918.
Pine timbers	190	Nov., 1915, to Dec., 1916.	193	Jan. to Sept., 1918.
Pitch-pine boards	370	Dec., 1916.	213	July to Dec., 1918.
Pitch-pine timbers	1,241	Nov., 1918.	193	Jan. to Sept., 1918.
	Japan			
Pine boards	221	Mar. to May., 1918.	167	July to Dec., 1918.
Shingles	206	Sept., 1917, to June, 1918.	184	May, 1917.
Newsprint	270	Oct., 1918.	172	Nov. and Dec., 1918.
Cedar boards	196	Mar. to May., 1918.		No American items to correspond with these.
Cedar logs	134	Dec., 1917, to Oct., 1918.		
Cedar timbers	233	Apr. to Oct., 1918.		
Pine logs	167	Apr. to Oct., 1918.		
Pine timbers	200	Apr. to Oct., 1918.		
Keyaki timbers	120	Oct., 1916, to Oct., 1918.		
Moni timbers	222	Apr. to Oct., 1918.		
Chestnut R. R. ties	194	May, 1918.		
Paper mine	236	Oct., 1918.		
Charcoal	276	Dec., 1917, and Sept., 1918.		
Firewood	150	Sept. and Oct., 1918.		
	India			
Teakwood	107	Sept., 1915.		

NOTE.—Australian quotations for resin and turpentine end with July, 1918. The quotation on pine flooring for November, 1918, is also missing. The American figures for flooring end with September, 1918.

Italian quotations end with 1916, except those for pitch-pine timbers, which are given for December, 1917, to December, 1918.

Japanese figures end with October, 1918, and those for India in July, 1917.

That prices of forest products should rise more sharply and to higher levels in the countries named than in the United States is only what would naturally be expected, since these countries (Japan to a less extent than the others) normally depend on imports for a large part of their supplies. America, on the other hand, produces within its own borders practically all of the forest products it uses, or imports them from across the imaginary line between this country and Canada. It is interesting to note that dyewoods (fustic and logwood), which come from outside, rose higher in the United States than in England.

Lumber dealers in importing countries during the war not only had to contend with the natural rise in prices due to increased costs at the point of production, but they had the additional handicap, not suffered by dealers in producing countries, of abnormally high ocean freight rates, and, even more serious, of later being unable to import commodities at any freight rate, due to the submarine menace and need for ships for other uses. The natural result of this condition was that, with the law of supply and demand left to work unchecked, prices began to sky-rocket as soon as the stocks on hand began to become exhausted with practically no more imports coming in. The United States did not have to contend with this condition, except for temporary local freight embargoes. It is unfortunate that comparative prices for forest products could not be included in the tables for the other lumber exporting countries, Norway, Sweden, Russia, and Austria, and even for Germany and France, which normally import large amounts in addition to their considerable home production. Quotations for the first four of these countries would afford a much more satisfactory comparison with American prices than do those which are given.

W. N. S.

Forest Management. By A. B. Recknagel, B. A., M. F., and John Bentley, Jr., B. S., M. F. xiii + 267 pages. 1919. John Wiley & Sons. $2.50.

According to the preface of this volume, in which the authors feel the need of justifying its appearance, it is written mainly for a special public, namely, the layman timber-owner and the non-professional student of forestry. It must therefore be read and judged from that point of view; the selection of material and the manner of presenting it must be specially adapted to that class of readers. The private timberland owner in particular should find in it a guide to practical application.

We regret to say that from this latter point of view we are somewhat disappointed. For practical purposes, there seems to us both too little and too much; too little in the way of explaining principles and too much in describing methods; too little practical aid in choice of methods and too much academic discussion. While, for instance, the chapter on "Forest Administration" is interesting enough, it lacks practical value; it could have been greatly condensed, and part of the eighteen pages could have been usefully employed in expanding on silvical topics in order to help the readers in forming a judgment as to the choice of silvicultural methods. Occasion should also, in that connection, have been taken to define forest types—a term used repeatedly without definition, as far as we could find.

In the chapter on "Regulating the Cut" (or, as we prefer, the felling budget) the lack of a clear statement of principles and the almost exclusive reliance on mathematical formulæ will make tough reading for the average timberland owner and the choice of method puzzling. Altogether, mathematical formulæ and discussions in various parts of the volume are of questionable value for the particular class of readers, as, for example, the formulæ for contents of geometric solids, on page 44, which seem to us an unnecessary addition. Sometimes mathematics are misleading, as, for instance, when according to table on page 13 the cost of a boundary survey of a 10-acre lot works out only $1.

Under "Rotation" it would have been pertinent to give a practical example how to come to a technical rotation. A simple improvement of determining this rotation might have been mentioned, namely, basing it on desired log length and diameter at the small end, when the time for reaching the log length plus the time for making that diameter will be the rotation. That this rotation "is the one most commonly used in the United States" would make it appear as if anything in forest management is "common" with us.

What would a private timberland owner do with the elaborate working plan, the outline of which covers more than 10 printed pages?

Perhaps we have been unfair in viewing the work from too narrow a point and assuming an object which was not in the mind of the authors. If so, the volume for the practice of the private owner is still to be written. For the present work the authors would have been perfectly justified in claiming a place as a repetitorium for technical students and perhaps as a handbook for ranger schools, to be used under competent guidance.

There are only a few technical questions on which we may make observations.

We believe more credit is due to the Schneider formula (page 111), which, it should have been stated, is really the formula for basal area increment, and can, with certain reservations, be usefully applied in determining increments of volume of stands.

We applaud the scoring (page 113) of the large number of forest mathematicians who still think they can solve the practical impossibility of determining increment in selection forest.

In the chapter on "Regulating the Cut" we find fault with the description of Heyer's method. It is not at all in the spirit of Heyer to rely exclusively on a formula, and he warns particularly against its use except as a check on an area allotment. Besides, his use of the increment is peculiar and different from that stated, namely, a combination of actual and normal increment. There is no other method that could be more satisfactorily used to demonstrate principles in budget determination.

In the same chapter the explanation of a cutting or felling series could be improved and the statement left out that it is inapplicable in the selection forest, for in the well-managed selection forest a purposeful distribution of age classes is also attempted.

An interesting technical inaccuracy occurs on page 144, quoting the definition of soil rent (after on page 143 a correct definition has been given) as the largest per cent on the money invested in the forest. It should read on the investment *value* of the forest. Since this misunderstanding is rather general, we may go out of our way here to clear up the difference. Fifty years ago the annual net income of the Prussian State forests was around 80 cents per acre, on the average. Let us assume that the property was then sold for the capitalization of its income with a 4 per cent discount rate—that is, for $20 per acre. This to the purchaser would be the investment, the "money invested in the forest." Forty years later the investment of the purchaser would still be $20, but, if he managed as the State has actually done, the net income was around $2.50, or 12.5 per cent, and the investment *value* could be figured, say with a 5 per cent discount rate, at $50 per acre. The 2 to 3 per cent soil rent calculation of German State forests are figured on investment *value*, not on actual investment.

We would question the propriety of translating (on page 183) 100 cubic feet to "about 623 board feet," costing in Germany to produce $4.17. Such translation would naturally lead the reader to suppose this to be the cost of saw material, while the 100 cubic feet includes around one-third of cordwood, and the cost of the material that can be sawed into boards is therefore above $6 per 100 cubic feet, which may amount to, say, around $8 per thousand feet.

An appendix brings a number of useful tables; among them a very welcome list of references to volume and growth tables and a tabulation of data for determining technical rotations.

In its outward appearance the volume has the stamp of elegance and perfection which we are accustomed to see come from the Wiley publishing house. We note only one curious defect, namely, the frequent dropping of single letters out of words. (See pages 42, 43, 46, 47, etc.)

B. E. F.

Report of the Division of Forestry, Board of Agriculture and Forestry, Territory of Hawaii, for the Biennial Period Ended December 31, 1918. By C. S. Judd. Honolulu, Hawaii, 1919. Pp. 53, 5 maps, 5 full-page illustrations.

Perhaps the most significant statement made in this report is that "the setting apart of the general forest reserve system has been accomplished." This means that the Territory of Hawaii has officially brought within forest-reserve boundaries all the land that it is deemed necessary to maintain permanently under forest cover to safeguard "a continued and steady supply of water for the use of agricultural and domestic pursuits in the Territory." During the biennium 44,476 acres of forest land, in nine forest reserves, were added to the system. This brings the total area of the forest reserves in the islands to 814,926 acres, of which 554,842 acres, or 68 per cent, is land belonging to the Territory. It may be recalled here that the first Hawaiian reserve was set apart in November, 1904. With an acreage today that is approximately 20 per cent of the total area of this entire group of islands, it will be seen that Hawaii's interest in forestry is more than academic. Tabular statements and colored maps of the five principal islands give details as to the area and location of the 47 reserves.

But as Mr. Judd clearly sets forth the demarcation of boundaries is only the first step toward adequately establishing the type of protection forest that island conditions demand. The development of an administrative field force, the fencing of reserve boundaries, and extermination of wild cattle, pigs, and goats is the work that now bulks large. There are now seven forest rangers, distributed on four islands. Three more are required. Fencing of the boundaries is actively going on, often at a cost of over $500 per mile; but, owing to the nature of the land, short stretches of fence, as across a valley, protect large areas of forest on the mountains. Where suitable local posts are not obtainable, redwood posts are used, with five strands of a special No. 6 galvanized wire.

The eradication of wild stock is also progressing, through cattle-drives followed by systematic shooting. Fortunately, forest fire is not a large factor in Hawaii. The absence of fires in the drier district is due in part to the well-organized fire-warden system. For the most part the fire wardens are sugar-plantation managers, who command large numbers of laborers.

That interest in forestry is increasing is shown by the establishment of a Division of Forestry under the Hawaiian Sugar Planters' Association, which will co-operate with the Territorial forester in proper care of certain of the forest reserves. Similarly, the recent appointment of an assistant forester indicates that Mr. Judd's recommendation in this report, that there was much need for such a man, was favorably received.

The second branch of forest-work in Hawaii is the extension of the forest area through planting. The emphasis in recent years seems to have shifted from the reforestation of waste areas on the sugar plantations with exotic trees of value for fuel and other local uses, like certain of the eucalypts, to the planting up of depleted areas on the watersheds with native trees. The Koa (*Acacia koa*) is the species most used. But much interesting work is also being done in the experimental planting of trees from many parts of the world, to determine their suitability for local use. In the tree-planting on private lands, largely sugar plantations, *Eucalyptus rostrata* seems to be gaining in favor as compared with *E. robusta*, though the latter is still the more popular tree. Much of the nursery stock for this planting is supplied by the Territorial Division of Forestry. Territorial forest nurseries are maintained on three islands to take care of the demand, which amounts to over 300,000 seedling trees a year. The trees are sold at cost price.

Along with distibution, considerable work is also done at the Honolulu Nursery in propagating exotic trees for experimental planting. A consulting botanist, Mr. J. F. Rock, is on the staff of the Division of Forestry. His report, appended to Mr. Judd's, contains some interesting notes on these species. Mr. Rock is the author of several bulletins recently brought out by the Division of Forestry—"The Ohia Lehua Trees of Hawaii," "The Arborescent Indigenous Legumes of Hawaii," and "The Hawaiian Genus Kokia—A Relative of the Cotton." The two last-named bulletins were published in June, 1919; the other in 1917. Another publication of value to those interested in forestry in Hawaii is a reprint of an article by Judd that first appeared in the *Hawaiian Forester and Agriculturist* for May, 1918. This pamphlet should be consulted by those who wish to know the whys and where-

fores of the methods followed in the islands. It is called "Forestry as Applied in Hawaii."

A new departure in Hawaii was inaugurated in 1918 when camp sites were leased in one of the forest reserves on the Island of Kauai. Situated near a canyon of great scenic beauty, the holders of these camping privileges will have good reason to be glad of the extension of the Territory of this Forest Service usage. Record of miscellaneous work of one and another sort, including the protection of the bird life on certain small islands near Honolulu, shows that the time of the Superintendent of Forestry is well occupied, especially as he also acts as executive officer of the Board of Agriculture and Forestry. Altogether the report is a creditable presentation of useful work well accomplished.

It is only to be regretted that provision does not seem to have been made for continuing the work of experimental tree-planting on the higher mountains of the Territory, above the level of the moisture-bearing clounds, that was started some years ago with the aid of the Forest Service. In that part of the Territory the indications are, from the little work so far done, that trees of economic value from the temperate zone, adapted to semi-arid conditions, might be made to thrive and develop into forests on what is now for the most part only waste land. It is to be hoped that eventually the Territorial authorities will see fit to devote money to the continuation of these studies.

Forestry in Hawaii is essentially a problem of how to manage protection forests so that they shall be of the greatest possible service. The main industry of the islands, the production of cane sugar, is dependent in large part on irrigation. Unless the watersheds are kept permanently under forest cover the water supply cannot be assured. Consequently the forest reserves that this report describes are playing an important part in the domestic economy of the Territory. Hawaii is not great in area, but because of its geographic position it presents interesting problems of many sorts; and not least among these is that of its forests.

R. S. H.

A New Dendrometer. By Donald Bruce. University of California Publications in Agricultural Sciences, Vol. 3, No. 4, pp. 55-61. Berkeley, Calif., November 27, 1917.

Bruce has invented a simplified dendrometer based on a somewhat different principle from those previously devised. It consists essentially of a straight-arm upon which are mounted two small mirrors, both at an angle of forty-five degrees with the axis of the arm, parallel

to each other and facing in opposite directions. One mirror is fixed at one end of the arm, while the other is mounted on a slide which travels along the arm. Graduations permit a direct reading of the distance between the mirrors.

The instrument is closely akin to the ordinary calipers in principle, except that for the parallel fixed and movable arms of the calipers are substituted two parallel lines of sight. The direct line of sight passes just above the upper edge of the fixed mirror from eye to one edge of the tree, while the indirect line of sight is reflected in each of the two mirrors to the edge of the tree. Since the two lines of sight are parallel, the distance between the two mirrors is equal to the diameter of the tree.

The chief advantages of this instrument are that it is direct reading, does not require the determination of the distance from eye to tree, and hence is not only rapid in use, but may be set for a given diameter, regardless of distance. It is more portable than a pair of calipers of the same range.

A modification of this type of dendrometer is suggested for timber-survey crews which are using volume tables to a fixed top-cutting limit such as six or eight inches. All that is necessary in such cases is the pair of parallel mirrors, one of which is adjustable, mounted six or eight inches apart on any light base not affected too readily by changes of temperature or humidity.

This instrument would seem to possess considerable merit and deserves a careful trial at the hands of the profession. A. B. R.

Instructions for Making Timber Surveys in the National Forests. U. S. Department of Agriculture, Forest Service. Washington, D. C., 1917. Pp. 53.

The purpose of this handbook is to present the policy of the Forest Service for the conduct of timber surveys and to standardize the methods used in the districts to the extent necessary to insure reasonably accurate and uniform results. Conditions in the districts differ to such a degree that in some respects standardization of methods is not felt to be desirable. It will be necessary, therefore, for each district to issue supplemental instructions to its field officers, based upon the principles herein outlined, regarding methods not standardized by this handbook. This purpose the handbook fulfills admirably. It is clear, concise, and compact; yet it covers all the essentials, such as organization, field methods, progressive steps in timber-survey projects, project report,

forms, administrative reports, records, and equipment. There follows (page 38) a most interesting standard classification of forest types as they occur in the various districts.

The immediate object of timber surveys is stated as "primarily to secure data needed in connection with timber sales." It is the policy of the Forest Service to have a thorough examination made of prospective timber-sale areas as a basis for determining whether a sale is silviculturally desirable as well as for the timber appraisal. The preparation of a topographic map is a requisite; therefore timber surveys also give data needed in the preparation of plans for fire protection and forest improvements. Since timber surveys are essential to intensive forest management, they will be extended as rapidly as funds are available.

Up to and including the fiscal year 1916, 47,291,660 acres have been covered by extensive timber surveys and 20,815,798 acres by intensive methods. It is estimated that there remain 90,000,000 acres of National Forest lands bearing timber of commercial importance to be covered by surveys before complete data essential to forest working plans are secured.

Under the caption of "Yield and increment," it is stated that "so far as practicable, the data secured on timber-survey projects will be utilized in the construction of yield tables showing the actual yield of the watershed covered. Actual or empirical yields of the area in question may be secured from data on even-aged stands where the tallies are kept separate by type and age classes and in uneven-aged stands upon which the area of growth below merchantable size is determined."

A. B. R.

Canadian Douglas Fir: Its Mechanical and Physical Properties. Bulletin No. 60, Forestry Branch, Department of the Interior, Canada.

This publication, the first to deal with the results of strength tests made at the Canadian Forest Products Laboratories at Montreal, presents data on five trees of Douglas fir from each of three localities of growth and represents two types (coast type from Abbotsford, B. C., and mountain type from Golden, B. C., and Morley, Alta.). It is shown, as has been done by our own Forest Products Laboratory, that the coast type fir is considerably superior to the mountain type. Attention is called to the fact that, in general, the properties are well correlated to the climatic conditions under which the trees were grown. The coast type, of course, grew under the conditions of higher temperature and heavier rainfall. Of the mountain localities that having slightly

heavier rainfall and higher temperature produced somewhat superior material. In fact, the differences in strength values are somewhat larger than one would be willing to attribute to the comparatively small difference in climatic conditions. Material from the region of Golden, B. C., seems to be intermediate between the coast and true mountain types and compares closely with Douglas fir from the coast region of California.

Maximum and minimum values for the localities are in the same order as averages, but tables of data show that some material from the locality giving the lowest average is better than some from that giving the highest; hence source is not a criterion of either excellence or inferiority of material, and the need for a quality classification of Douglas fir, such as has been advocated by the United States Forest Service, is again illustrated. One of the conclusions reached by the authors is that "it would appear that a grading rule based on density, as visually indicated by the amount of summerwood, is a promising possibility for Douglas fir, as for certain other species, and that a clause in such a rule specifying the minimum number of growth rings per inch for material of first grade would be of value."

Comparisons with data from the United States Forest Service show that Canadian Douglas fir has practically the same strength value as Douglas fir from the corresponding type of trees grown on our side of the boundary.

A map shows the origin of the three shipments of material and numerous diagrams illustrate the effect of drying, the correlation between strength values and various physical factors, and the variation of mechanical properties with position in the tree.

An appendix of some 20 pages explains and illustrates the selection of test material, the methods of tests, and testing apparatus, all of which are closely patterned after—in fact, with the exception of some unimportant details, are identical with—the working plan adopted by the United States Forest Products Laboratory as a standard for testing American species. The use of these common methods and standards is of great advantage, as it makes the results obtained at the two forest-products laboratories concerned with the testing of North American woods directly comparable.

It seems unfortunate that our Canadian friends are apparently unwilling to accept our standard nomenclature as given in Forest Service Bulletin 17, but prefer to use the species name *mucronata* for Douglas fir.

T. R. C. W.

Economic Woods of the United States. By Samuel J. Record. John Wiley & Sons, Inc. Second edition, 1919.

This is a revision of the first edition, which is so well known to forestry students. Only a few changes of minor importance, chiefly in nomenclature, were made in Part I, Structural and Physical Properties of Wood. The author changed "bars of Sanio" to "Trabeculæ: Sanio's beams" and "tier-like arrangement of elements" to "'ripple-marks.'"

The essential differences between this edition and the first (1912) are briefly stated in the preface of the second edition, as follows: "(1) The key has been entirely rewritten and rearranged, several new woods are included, and more of the common names are given; (2) the lists of references and the general bibliography have been brought up to date; (3) an Appendix has been added which amplifies some of the subject-matter of Part I and also includes considerable new data on wood structure."

The principal changes in the key are as follows: Mesquite, yellowwood, California pepperwood, and apple have been added to the key, and Engelmann spruce has been grouped with white spruce. Water ash and box elder have been removed from the key proper and put into foot-notes. Water hickory has been combined with the other pecan hickories. Red spruce and black spruce have been combined into one group, as also have hackberry and sugarberry, and winged elm and cedar elm.

The key has been rearranged so that, as far as practical, woods with similar properties are close together. For example, Douglas fir follows the Southern pines, cypress follows redwood, and blue beech follows hop hornbeam. In the first edition these were separated by other species. The propriety of this change is questionable. It is doubtful, for instance, whether the new classification of Douglas fir with pine under "Resin ducts plainly visible without a lens, numerous to moderately so, and fairly well distributed" is as good as that in the first edition, in which Douglas fir was grouped with tamarack under "Resin ducts mostly inconspicuous, not numerous, irregularly distributed or grouped." The reviewer believes that the resin ducts in Douglas fir are more like those in tamarack and spruce than like those in pine, and that accuracy has been sacrificed for convenience in placing the fir with pine instead of with tamarack and spruce, which are in the same group in the second edition.

A feature of the new key is that all characters requiring a microscope for observation are given in smaller type.

As in the key in the first edition, the gross characters form the principal basis for separation of species, but microscopic characters are sometimes used. This presupposes a knowledge on the part of the user of the key of the minute structure of the wood, which makes the key of value principally to the trained wood technologist. To facilitate the use of the key for both the layman and the student who does not have a microscope available, as in field-work, it might have been well to have made one key, based entirely on the characters seen with the naked eye and the hand lens, and another based largely on microscopic features. A combination of the two, unless the microscopic features are entirely subordinated, does not make the most practical kind of a key.

A great improvement found in the new edition is the addition of an Appendix of 20 pages. The Appendix contains first a discussion of the botanical classification of American species, with tables showing the number of families, genera, and species in each group; then follows a discussion of wood structure, the various kinds of elements in wood and their distribution, supplementing Part I. Several tables are included, showing the occurrence of simple and scalariform perforations in native woods, spirals in vessels, the nature of the pits in vessel walls where in contact with ray parenchyma, the occurrence of tyloses and gum deposits in vessels, the nature of pitting in wood fibers, kind of rays in native woods—that is, whether heterogeneous or homogeneous—and finally a list of indigenous woods with "ripple-marks." This compilation of data on native woods is of inestimable value to the student of wood. Much of the data is original and all of it is presented in a new form, which makes it very convenient for reference.

A. K.

Final Report, Forestry Sub-Committee of Reconstruction Committee, Ministry of Reconstruction. London, 1918. Pp. 106.

This painstaking document, elaborated during the throes of war, is worthy of study by those of our foresters just now considering the need of a national forest policy. It develops with considerable detail, in a sound and statesmanlike manner, the establishment of a Forest Service and a planting and reforesting campaign.

A brief historical sketch brings out the futility of attempts in the same direction made by previous committees for the last 30 years; the latest, based upon a general development fund established in 1909, having by 1916 through various agencies spent only about $358,000, of

which less than $35,000 for planting schemes, the balance mostly for educational purposes.

Only incomplete statistics are available upon which to base the committee's calculations. They bring out the facts that the United Kingdom has the smallest forest area per capita in Europe, namely, 4 per cent, with a little over three million acres, of which one million are unproductive; that 45,000,000 cubic feet is the annual cut, which could be increased to 60 million; that before the war importations had increased steadily for hewed and sawed material and staves for the last half century at the rate of 5 per cent (5 million cubic feet per year), or from 3.5 cubic feet per capita in 1851 to 10.5 cubic feet in 1911, trebling in 60 years; that, including all forest products and derivatives, the average of imports for the 5 years from 1909 to 1913 was valued at $227,000,000, rising in 1915, with reduced quantities, to $260,000,000.

It is significant to note that nearly half the import of coniferous wood and pitwood came from Russia, some 250,000,000 cubic feet, which not unlikely accounts in part for the Archangel campaign. The continuance of wood imports from Scandinavia, next in amount, is also questionable, having dropped off in later years, and anxiety of further reduction from all countries leads the committee to treat the problem of growing home supplies as a safety problem. "The United Kingdom is dependent for more than 60 per cent of its timber on the virgin forests of foreign countries which are being steadily depleted."

A continuous rise in prices of wood adds to the national anxiety about wood supplies. This advance began sharply since 1895, but, of course, progressed excessively during the war years. A table gives comparison of the average prices for 1909-13 and the years 1915 and 1916. Calling the price in the first period 100, an increase to 161 and 186 in the first and to 254 and 287 in the second year is quoted for the more important items. It is calculated that in these two years $185,-000.00 excess over the previous period was paid for wood supplies.

Upon the basis of these data the necessity of a national forest policy with a view to increasing home supplies is argued.

Just as the reviewer has contended as regards our own forestry problem, the committee concludes that "the problem of bringing woods in private ownership to a uniform state of high productivity has not yet been satisfactorily solved, though many countries have attacked it energetically. We think, therefore, that any effective scheme for the intensive management of British woods would necessarily have to be based on State purchase, and State purchase of existing woods must

lead to far greater outlay than is contemplated under the schemes of afforestation which we recommend.

Nevertheless, the program includes attempts to stimulate private forest management in part. Among the methods proposed to engage private interest, one novel one is that of "proceeds sharing," a system of partnership between the owner and the State whereby in broad outline the owner would provide the land for planting and the local management, the State would provide the money for afforestation and the control of management, and the net proceeds would be divided on an equitable basis as they accrued. We think that this system might provide 25,000 acres in the first ten years.

It is calculated that an annual requirement of 638 million cubic feet must be met, the bulk (620 million) coniferous. A production of 70 cubic feet per acre (40 cubic feet of large timber) in an 80-year rotation may be expected from conifers, which works out the need of planting of 1,770,000 acres, the bulk of which is to be accomplished in 40 years, 200,000 acres in the first decade and at the rate of 320,000 acres in the subsequent decades—not a difficult task or unreasonable, since it is found that there are between four and five million acres of non-agricultural afforestable land in the Kingdom.

Three agencies are expected to participate in this program—the State, municipalities, and private owners. Various schemes, concurrent or alternative, are suggested to induce the latter class to plant wastes and to replant cut-over woodlands. The most promising is a system of partnership, referred to above. "The advantage of proceeds-sharing schemes would be most felt in districts where the proportion of plantable land was comparatively small, and complicated questions of wintering, sport, etc., arose in connection with the occupation of the unplantable areas."

Direct grants at once or in annual payments, loans, relief from tax for a period of 30 years, and compulsory reforesting are suggested.

It is to be noted that the financial assistance contemplated is quite substantial, namely, around $10 per acre for new planting and $20 for reforesting of cut-over lands. Note the difference! If this were to be changed into an annuity, it is proposed to be calculated at 5 per cent for 10, 15, or 20 years. "Such a method of payment would have the advantage to the State that it would decrease to a minimum the amount which would have to be found in the early years of the scheme, and that if the conditions were completed, there would be a less sum to be recovered."

As regards compulsory replanting, the committee questions practica-

bility and proposes for these cut-over-lands planting the grant method of assistance. It is expected that under these various methods of assistance, in the first ten years 100,000 acres would be planted, leaving 150,000 to be undertaken by the State.

In the case of the State the first problem is the acquisition of land, whether by purchase, lease, or expropriation. Purchase and expropriation are to be used as sparingly as possible. Leasing—preferably perpetual, and if terminable at least for a rotation—is a novel method.

"Short of ownership, a perpetual lease is the only really sound tenure for a forest. If a terminable lease be for any reason necessary it should not be for a less period than a whole rotation. But it ought not to be impossible, in the case of a lease for a definite period, to give the owner the right of taking over the management of the land with the authority's consent at any period when a satisfactory valuation could be made of the work done by the authority, such valuation being then paid by the owner to the authority."

It is expected that two-thirds of the requirement of land to be planted during the first decade may be secured by leasing one-third, or 33,000 acres, annually by purchase. In figuring the cost of the scheme it is assumed that some of the land acquired will not at once be planted and may be temporarily leased for other purposes.

The question of employment in its relationship to afforestation schemes, which was prominently discussed in previous committee reports, comes in for consideration. It is figured that for every 100 acres planted $2,500 in wages will be spent, "a full year's wages for rather less than 8 men," and 10 to 12 men may be required under some conditions as against 2 or 3 in herding.

The financial aspect of afforestation is recognized as one "to be approached with caution."

The cost of planting, everything included, is placed at the comfortable figure of around $26.65 per acre; the cost of administration and protection at 97 cents (4*s.*), road-building and maintenance at 43 cents; total outgo, around $28. The returns are figured on the average production of five conifers—Norway spruce, Scotch pine, European larch, Douglas and Sitka spruce according to normal German (although not mentioned as such!) yield tables and other measurements. Since these represent 100 per cent efficiency, the calculation is also made for 70 per cent efficiency as more nearly approaching average conditions. There is a table and diagram of curves relating the returns to the cost (and presumably the quality) of the soil, when the return per cent on pre-war values appears on a 70 per cent efficiency as ranging from 2 to 3.2 per cent, the lower figure, of course, for the more expensive soils.

Since the calculation is made with present (pre-war) prices, this will unquestionably represent minimum returns. An increase of 2 cents per cubic foot would be 19 per cent on the price of Norway spruce, while in the 18 years before the war the price increment was 33 per cent.

There remains the problem of organizing the agencies through which to carry on the work, the institution of a "forest authority." The question whether to make this authority an attachment to existing departments—agriculture, for instance—or independent central one is decided in favor of the latter, after the unsatisfactory experience with attached to territorial authorities made hitherto. But the machinery proposed appears to us unnecessarily cumbersome. There is to be a six-headed Forestry Commission, with three paid, one of them at least a technically trained forester, and three unpaid commissioners, one of the latter being a member of Parliament. Four assistant commissioners are to look each after the interests of one of the four sections—England, Scotland, Wales, and Ireland. In addition, consultative local commissions, one for each section, are to be formed, on which county councils, forestry societies, boards of agriculture, and private owners are to be represented.

To this organization a forestry fund to finance the operation for the first ten years is to be made available—a wise provision. A summary of this budget, totaling around 17 million dollars, covers the following items:

1. Scheme for afforesting 150,000 acres by direct State action	£2,245,000
2. Advances to local authorities and private owners	327,500
3. Purchase and reconstruction of devastated hardwood areas	300,000
4. Education	45,000
5. Research and experiment	30,000
6. Establishment charges	446,000
7. Encouragement of forest industries	25,000
	£3,418,500

The report itself has appended 8 appendices of memoranda, statements, and details upon which the argumentation is based, the whole being a businesslike document from cover to cover. B. E. F.

Tests of the Absorption and Penetration of Coal Tar and Creosote in Longleaf Pine. By Clyde H. Teesdale and J. D. MacLean. Bulletin 607, Department of Agriculture, contribution from the Forest Service, June 7, 1918. Pp. 42, illustrated.

Mixtures of creosote and tar are being widely used at present for wood-preservation purposes, especially in the case of paving blocks.

The toxicity of these mixtures is an established fact and they are much cheaper than creosote. The investigation described in this bulletin gives valuable information on the absorption and penetration secured with various of these mixtures as compared with results secured with creosote, using yellow pine for all tests. Special laboratory apparatus was used for the penetrance tests, and the impregnation tests were made in a cylinder under pressure. The effect of varying time pressure and temperature were also studied.

The authors are extremely conservative in their conclusions. We learn that temperatures as high as 200° F. materially aid in securing satisfactory absorption of products containing a large percentage of by-product coke-oven tar; that with the use of tar alone or in mixture with creosote the difficulty of injection would increase as the percentage of tar and free carbon was increased; that mixture containing low-carbon tars are preferable, and that the practice of filtering free carbon, sometimes resorted to, seems to offer a means of improving the penetrating properties of the preservative.

Anything which will reduce the cost of a wood preservative without impairing its efficiency is a direct aid to the industry and to the business of conserving timber supplies. It is because of its bearing on these questions that the bulletin is worthy of thoughtful study by foresters.

S. W. A.

Forests of British Columbia. By H. N. Whitford and R. D. Craig. Report of Commission of Conservation, Ottawa, Canada, Committee on Forests. 1918. 409 pp., 27 pl., 21 maps.

This is a report of great value, the result of three years' work by the authors in securing personal knowledge of local conditions in each district and in compiling a large amount of data, including detailed estimates and reports on stands furnished by the British Columbia Forest Branch, timber-owners, cruisers, surveyors, and others. The area of the province is 355,855 square miles, or one-tenth larger than the combined areas of Washington, Oregon, and California. The forest land area of the province is placed at 149,344 square miles, as compared with 117,000 square miles in the Pacific Coast States, but the stand of merchantable timber in the former is estimated at only 366 billion board feet as compared with 1,300 billion in the latter. The timber on two-thirds of the forest land area of the province has been totally destroyed by fire and over half of the remainder has been seriously damaged; 200,000 square miles of the province is non-forest

land, incapable of producing forests of commercial value. Over half of the area of the province is unsuitable either for forestry or agriculture. About 145,000 square miles of this lie above merchantable timber line and 55,000 below timber line, with soil either too rocky or wet or the forest so completely destroyed by fire that there is no hope for the natural re-establishment of forest conditions for centuries to come.

The coast forests of the province comprise only 23,447 square miles of the forest land area, 11,362 square miles of which is merchantable timber with an average stand of about 30,000 board feet per acre; while the interior forests comprise 125,897 square miles, 40,649 of which is merchantable forest with an average stand of about 5,000 board feet per acre. The total stand of timber is estimated at about 230 billion feet in the coast and 137 billion in the interior region. The forest land area comprises 36.5 per cent of the coast region, 43.4 per cent of the interior region, and 42.2 per cent of the entire province.

The timber of the province is practically all softwood, containing the following estimated amounts and per cents:

Species.	Coast.					
	Million board feet.	Per cent.	Million board feet.	Per cent.	Million board feet.	Per cent.
Western red cedar.....	59,949	28.0	18,019	13.2	77,968	22.2
Douglas fir	63,4[illegible]0	29.6	12,019	9.2	75,973	21.7
Spruce (all species)...	14,165	6.7	58,899	43.1	73,064	20.8
Western hemlock	51,948	24.2	12,164	8.9	64,112	18.3
White fir (balsam)....	19,115	8.9	13,838	10.2	32,953	9.4
Lodgepole pine	68	....	11,793	8.6	11,851	3.4
Western yellow pine...	......	....	4,208	3.1	4,208	1.2
Yellow cypress	4,056	1.9	......	....	4,056	1.1
Western larch	.....	....	3,152	2.3	3,152	.9
Western white pine....	1,083	.5	1,617	1.2	2,700	.8
Cottonwood	516	.2	272	.2	788	.2
Total saw material. .	214,300	....	136,535	....	350,835	....
Piling, poles, pulpwood, etc.	15,465	....	......	....	15,465	....
Total forest resources	229,765	...	136,535	....	366,300	....

The report analyzes in detail the timber and forest conditions, physical features, and land classification separately, by regions, districts, and drainage basins. There are separate silvicultural descriptions of all the important species, including character of occurrence, stand per acre, silvical characteristics, and utilization, together with notes on insects attacking British Columbia trees.

There are three interesting chapters dealing in broad aspects with the effect of geographical, physiological, and climatic and soil relations on occurrence of forests and forest types, their economic importance and utilization, and on forest fires.

The chapter on land tenure describes the salient features of the various forms of tenure and their relationship to forest administration, including timber leases and timber sales. Chapters on forest administration on provincial and Dominion land describe the workings of forestry regulations and revenue secured on these two general classes of land.

A chapter on forest policy draws attention to a few points not sufficiently covered in preceding chapters, including the subjects of forest revenues and of the need for scientific forest research and for a college of forestry.

A chapter on forest exploitation describes the development of the lumber industry in British Columbia, methods and costs of logging, amount of timber cut in various years, logging regulations, and stumpage values. The largest reported lumber cut is for the year 1911, when 1,342 million feet were cut. The State of Washington cut over 4,000 million in the same year.

The report forms an encyclopedia of information on forest conditions and forest resources of British Columbia and gives an excellent basis for developing a permanent forest policy for the Province.

W. D. S.

The Northeastern Minnesota Forest Fires of October 12, 1918. By H. W. Richardson, U. S. Weather Bureau, Duluth, Minn. The Geographic Review, April, 1919.

The situation under discussion loses nothing from being retold again and again. In fact, until the public has more thoroughly learned the lesson which catastrophes such as these teach, the oftener they are retold and thus kept before the public the better, and the sooner we may hope to see an end of them.

And it is this phase of the subject which needs especially to be emphasized, namely, that the ultimate and final responsibility for the devastation and ruin wrought by such forest fires *rests with the public.* This is so in twofold degree: first, through the individual carelessness and indifference of those who start fires and neglect to control and put them out when they are small and can be easily handled; and, second, similar collective carelessness and indifference of society in failing to

adequately provide against both the occurrence and spread of fire in and adjacent to timber and logged-off land.

The article describes concisely, yet with sufficient detail to give a well-rounded idea of the situation and circumstances even to the reader who was previously entirely unfamiliar with them, the extent and character of both the region affected and the loss suffered, including human life, live stock, farm and city property, and public improvements. Many, too, are the instances of human interest cited—of cool, deliberate, and clear-headed leadership and personal abnegation and self-sacrifice unsurpassed by any reported from the field of battle; of the tragedy and horror of it all and of the kindliness and big-heartedness, the outpouring of men and money to aid and care for the stricken and provide shelter and a new start in life for those who had lost their home and their all.

The article is, however, chiefly noteworthy for its clear exposition of the relationship between natural causes, human carelessness, and criminal public negligence and responsibility for the magnitude and seriousness of the disaster. It shows convincingly to any fair-minded and unbiased person that what occurred was entirely preventable and unnecessary. Without minimizing the unusual dryness and the indications for the prevalence that day of fresh or moderately strong winds, the article puts the blame squarely on the existence of numerous controllable but neglected small fires, which in coming together created the gale and the resulting catastrophe.

In that particular it is notably different from the usual run of the accounts of this disaster. To be sure, one of the earliest unofficial accounts hinted that there were no general and unusual atmospheric disturbances to which to attribute the tremendous rush and roar with which the fires spread, and that the gale was a fire-generated one. The official version, emanating from the State Forester's office, however, which version is now chiefly quoted, gave the impression of being willing to "pass the buck" to nature. While it does not contradict the earlier version, in so many words, it does do so by inference, when it speaks of the numerous small fires fanned by a terrific gale into a raging conflagration, thus leaving one to infer that the gale was pre-existent.

Why this turn about when a much stronger case could have been made for the necessary State appropriation to provide adequate facilities to absolutely prevent or control small fires is not readily discernible. Legislators may be pardoned if they do not evince an overzealous interest in making large appropriations year after year to provide a

sufficiently large organization to fight a similar "visitation of Divine wrath" whenever it may occur in the future, but prefer to await its coming, and then do what they can to repair the damage and succor the stricken after it is passed.

In the light of the situation created by the State Forester's version, the following passages are especially noteworthy:

General Conditions.—"Except for the continuation of the dry weather (the season being the driest for 48 years), the general meteorological conditions on the morning of October 12 were not *unusual for the season.* The weather map, based on the 8 a. m. observations of that date, showed a low barometric pressure area of moderate strength centered over western Ontario, the inclosing isobar being 29.6 inches (corrected to sea-level pressure), and an area of high barometer of 30.2 inches extending from Wyoming, Utah, and Nevada to Washington; so that the air-pressure gradient *was by no means extraordinary.* Fair weather and winds from westerly directions, fresh or moderately strong (about 30-mile-an-hour rates), were indicated, and in addition a 'small-craft' wind warning was ordered displayed on western Lake Superior at 10:30 a. m. All of this was given the usual publicity."

Wind Velocities.—"At Duluth the weather was clear until about 12:30 p. m., when smoke began moving in from westerly sources; but, because of the occasional previous occurrence of such a condition, the smoke attracted little attention. After 2:30 p. m. it increased considerably, the sun appearing red or being altogether obscured most of the time thereafter—a manifestation common to fires of unusual character. The wind gradually increased also, reaching 30 to 40 mile rates from the west at times until about 3 p. m. After that hour there was a steady rise to gale proportions, 50 to 60 mile rates from the west-southwest-northwest occurring between 4:15 p. m. and 9 p. m. After this hour the wind continued at 40-mile velocities until about 2 a. m. of the 13th, subsiding materially thereafter. The highest 5-minute rate was 65 miles an hour from the west at 7:52 p. m., while the extreme speed for a less period was 76 miles about that time."

Cause of High Wind.—"Careful consideration of the available facts seems to warrant the conclusion that the major force of the gale which prevailed during the late afternoon and night of October 12 was fire-created. . . . Reliable reports show that in the immediate vicinity of the big fires the effect was comparable to a grate fire of enormous proportions; that there was an accompanying air movement or combustive draft of hurricane force; that the wind velocity was immeasurably greater in the immediate vicinity of the fires than it was a few miles distant, as in Duluth; and that there was a very noticeable decrease of wind from the fire zone outward. It has been estimated by some that while the wind at the Weather Bureau Station was blowing at the rate of 60 miles an hour, it must surely have been blowing at a rate of 80 to 90 miles adjoining the fire fronts from two to six miles or more distant from the station. There was an attendant deafening roar of fire and wind combined. In numerous instances people were thrown flat on the ground, and some automobiles were overturned by the wind in the vicinity of the fires. There are no authenticated cases of such accidents as these at the time except near the fire fronts. In many instances the rescue automobile engines and radiators were found to be clogged or covered with quantities of sand and gravel blown upon them in the fire districts. This sort of trouble was not experienced elsewhere during that period."

The article very properly concludes with a statement that the vital needs are for better and more adequate fire protection. And this is the chief thing to be hammered home, not alone in Minnesota, but throughout the country, and more especially where fire protection is practiced, where the public is, in most cases, self-satisfied and complacent. Willing to take the credit for keeping down fires when the weather is in their favor, they are equally willing to blame the weather when the fires get away and run amuck. There are States right now with protective organizations which are trying to build up a set of statistics which will tend to show their protective organizations efficient by shouldering the responsibility of unusual losses on the weather. It is, nevertheless, frankly admitted that their organizations can, in many particulars, and must be strengthened if they are to effectually control the human factors which are responsible for most fires in the first instance. The reflection is, however, not primarily on forest officers under conditions as they are, save to the extent that such officers fail to frankly meet the situation by fearlessly and unequivocally pointing out organization weaknesses. The public can have as good and adequate a fire-protection organization as it is willing to pay for.

L. M.

Trees of Indiana. By Charles C. Deam. Bulletin 3 of the State Board of Forestry of Indiana. 299 pp., 133 pl.

A revised edition of the 1911 report of the State Board of Forestry, with corrections, additional notes, and a new introductory chapter. Mr. Deam is a thoroughly reliable dendrologist. He has a complete private herbarium of botanical specimens of all trees native to Indiana, from which practically all the botanical drawings in the bulletin were made. He has carried on field investigations in all parts of the State during the last 15 years, in which work he specialized on the distribution of trees. The bulletin is of especial value to those interested in the authentic distribution of trees in the United States, as it indicates all counties in the State in which each species occurs. All publications bearing on the distribution of trees in Indiana were consulted, but the author has used his field knowledge of the State in judging the correctness of all reported occurrences of the different species. In the introductory part is given a list and critical discussion of trees reported by various authorities as occurring in the State, but which the author is convinced do not occur at the present time or never did occur as native in the State. This cutting down on the scope of previously reported ranges of certain trees is in itself a valuable contribution to dendro-

logical literature. The list of species given as not occurring include Pinus rigida, Chamæcyphasis thyroides, Populus balsamifera, Hicoria aquatica, Hicoria myristicæformis, Castanea pumila, Quercus ilicifolia, Q. nigra, Q. phellos, Planera aquatica, Ilex opaca, Acer pennsylvanicum, Nyssa aquatica, Halesia diptera, and Fraxinus caroliniana.

The bulletin contains valuable keys to families, genera, and species of trees occurring in the State. Under each species is given a plate showing leaves, twigs, and fruit, discussion of distinguishing botanical characters, importance, and range of the tree in the United States and Indiana, size and frequency of occurrence, distribution by counties in the State, and the economic uses and horticultural value and in some cases the best methods of planting.

There is also an interesting table of measurements on largest trees of some species occurring in the State. The author now has under preparation a book on the trees of Indiana which he expects to complete within about two years.

W. D. S.

The Reason for State Forests in the Canton Zug. By Ed. Sporri. Schweizerische Zeitschrift fur Forstwesen. 3 and 4: 41-43. 1919.

The attempted control of all business and factories by the State is an extreme and one-sided viewpoint. Necessarily State control of some industries and regulation of all must be continued, for the unity of the State. The forests are obviously one of the resources which require State control in order to keep the land productive and to stabilize labor and the distribution of the products, since the industry is fundamental to the State. All European governments are forest owners. In the United States, government ownership is receiving a great deal of attention, due to the destruction of the forests by private owners. By government control the forest becomes a constant spring as a source of products and industry.

This is the necessity for State forests in this Canton. The State forest of Ben, Schaff-hausen, Neuenburg, Friberg, and Waadt have been the chief support of the industries.

When the war began the Canton Zug did not have any State forests. In 1915 and 1916 two purchases were made (Hinterwyden and Brand). Other purchases were added during the next two years. Up to the present 92 hectares (about 185 acres) have been purchased, of which about 40 per cent is timbered.

The largest forested area is in the Hinterwyden-Diessel. This is at

an elevation of 900 to 1,000 meters, mostly middle-aged, with some mature coniferous timber.

The "Brand," in northeastern Rossberg, was hit by a wind storm which caused a very heavy windfall. Sawlogs and spar timbers are the principal output from this region. Under State control, this will become a productive forest region, whereas it never would under private control.

It is to be hoped that the problem of forest control will be solved at an earlier date than appears probable at present.

J. V. H.

Root Grafting. By Philipp Flury. Schweizerische Zeitschrift fur Forstwessen. 3 and 4: 37-41. 1919.

Grafting of stems and branches of the same tree or same species is a common occurrence. Occasionally branches of different species are grafted, although this is merely a mechanical union by a smaller branch becoming inclosed in a larger one, as mentioned in Dr. Klein's "Handbook of Forest Conditions," page 571. On page 574 the same author mentions the common occurrence of root grafting of the same species.

This paper presents the results of a study of root grafting and shows that grafting occurs only in roots of one or more centimeters in diameter and not in roots of only a few millimeters in diameter. A study of root surface and distribution afforded ample material to observe grafting under different conditions. All grafts were found to be in larger roots. Up to the present time no grafts of small roots have been found. The contentions that pressure exerted for a long period and favorable conditions of growth are necessary have been taken into consideration, but in no case have the grafts been found, even in dense mats of interlaced roots under heavy pressure, causing flattened surfaces.

Due to soil conditions, there occurs on the Brandiswold an unthrifty planted stand of spruce and Weymouth pine about 60 years old. The depleted soil consists of layers of fine sand and lime-lacking formations. This condition causes a dense mat of surface roots. Close study revealed no grafting in larger roots, although numerous roots were in contact under pressure. Similar conditions existed in the Doppwalder and in the Community Forests of the Canton Freiburg.

No root grafting has been found in potted woody plants such as spruce. In the fall of 1912 the author arranged roots of spruce, pine, fir, beech, oak, and ash in various crosses and exerted pressure on them

by means of wooden clamps. Since all of the clamps were not solid, the contacts were strengthened by winding in the spring of 1915. These experiments were conducted in the experimental garden at Adlisberg, Zurich. Up to the present no indications of grafting have been noted.

Why then do these small roots not graft?

Usually such phenomona are noted and passed, but it is of interest to look into the causes.

The functions of roots are twofold: to supply water and nourishment to the plant during their youth and later to serve as mechanical support to the plant. The absorption of water and salt solutions will be greater, other conditions being equal, the greater the root surface. Hence it is to the advantage of the plant to produce a larger mat of fine roots. On the other hand, there is no gain to the plant by the grafting of these small roots. This holds true in the case of larger roots.

That absorption roots would not readily graft, due to their elastic structure, is conceivable and is also apparent by their cell structure. During the short period of diameter growth of the root tip the new cells are added by cell multiplication at the growing tip just beneath the epidermal layer and from the outside; consequently grafting becomes impossible or at least very difficult. After the roots have formed a cambium ring and grow by cell division from the inside outward, the grafting becomes possible, the same as branches and stems. Grafting of roots after they are no longer absorption roots is no disadvantage to the tree, but rather strengthens its root system as a mechanical support.

Just as the radical is geotropic and the stem autotropic, so the cells of the root tips may have repulsive power to keep them separate. This is a problem for plant physiologists. These root conditions are merely mentioned in order to stimulate botanical research along these lines.

J. V. H.

Pulpwood Consumption and Woodpulp Production in 1918. By F. H. Smith, Forest Service, U. S. Department of Agriculture. Pp. 20.

The statistics in this compilation are remarkable by their completeness and accuracy, being actual returns from all but one of the 250 establishments in the country concerned in woodpulp consumption. This consumption has for the last three years exceeded five million cords, more than double the consumption of 1899. In value the year's cost of pulpwood exceeded 73 million, more than double that of a decade ago and nearly eight times that of 1899. Spruce is still by far the leading species, and, with balsam added, furnishes over 60 per cent of the

consumption, the next species being hemlock, with nearly 16 per cent. The increased use of hardwoods—beech, birch, maple, and chestnut—is noteworthy, although even now representing not quite 4 per cent, the bulk of the wood being used in soda and sulphate processes. Maine is still the leading producer, with only 33 establishments, while New York, with 75 establishments, is second, and Wisconsin, with 46, is third.

In these times of investigations into cost of production and official price-making, it is interesting to note that the prices paid for pulpwood f. o. b. mill ranged from $3 to $24 and up to over $30 for rossed, the majority of mills paying between $6 and $18, the average for the country being $11 to $12 for rough, $15 to $16 for peeled, $20 to $21 for rossed, and $8 to $9 for slabs. Comparing these prices with those prevailing in 1910, they show an increase of about 50 per cent. Imports of pulpwood are not reported, but imports of woodpulp amounted to around 31.5 million dollars against an export of 1.7 million dollars, imports over exports having grown to five times what they were ten years ago.

Thirteenth Annual Report of the Commissioner of Forestry, State of Rhode Island and Providence Plantations, Made to the General Assembly at Its January Session, 1919. Providence, R. I., 1919. Pp. 8.

A useless essay on the wrongdoings of farmers and lumbermen.

B. E. F.

Forest Disease Surveys. By J. R. Weir and E. E. Hubert. Bulletin No. 658, U. S. Department of Agriculture, 1919.

A very well argued plea for a more intensive determination of disease conditions of timber offered for sale in National Forests or elsewhere, to determine cull per cent; also for pathological maps to accompany timber estimates, location of nurseries and plantations. The methods to be pursued are conveniently tabulated.

PERIODICAL LITERATURE

BOTANY AND ZOOLOGY

Grafting Spruce on Pine

In South Sweden there was cut down a 56-year-old pine that bore a fresh living branch of spruce of 51 years at 5 feet from the ground. A nearer investigation showed that the spruce branch was really grafted on the pine in a natural way and has lived so without communication with the mother spruce at least fourteen years.

Romell describes and pictures the anatomy of the juncture. The coalescence surface has, microscopically seen, a very irregular shape. The foreign cells must be almost jumbled together in the cambium. The foreign cells are not, however, without influence on each other, since the several spruce pores are always arranged so as to fall within the area of the single corresponding pine pore.

The whole forms an interesting case of formative correlation between foreign tissues. The foreign cells, though to a large extent autonomically reacting in a morphological sense, react physiologically with each other in a throughout harmonious way as parts of a single organism.

Meddelanden Från Statens Skogsförsöksanstalt. Häft. 16, Nr. 2-3, 1919, 61-66.

Origin of Pith Rays

The author throws some light on the occurrence of the broad rays in oak with respect to conditions of growth. By selecting vigorous and suppressed shoots from three different oaks and making microscopic sections of them, he observed the following:

"Both uniseriate and multiseriate rays are usually present in the first annual rings, the latter radiating in pairs from each of the fine lobes of the pith. In shoots of vigorous growth the multiseriate rays are more numerous than in suppressed twigs, which gives added weight to the theory that the broad rays have some relation to the amount of food brought down for storage by the leaves. In suppressed twigs the multiseriate rays may be entirely absent from the first 15 to 19 annual rings.

"Multiseriate rays may arise at any point in the stem—not by a

gradual widening of a uniseriate ray or by the fusion of several smaller ones, but by the abrupt cession of growth of other tissue and the development of ray parenchyma." A. K.

La Dema M. Langdon: The Ray System of Quercus Alba. *Botanical Gazette*, vol. 65, 1918, pp. 313-323.

UTILIZATION, MARKET, AND TECHNOLOGY

Cause of Durability of Wood

Herbert Stone, author of "Timbers of Commerce and Their Identification," has ventured upon some interesting hypotheses as to the cause of the relative durability of wood. He suggests that "durability may be an absence of germs rather than a quality of a wood," but adds that it is the relative durability of woods placed under like conditions that is of practical interest. By a series of logical steps, the conclusion is reached that "it is not the lignin which is the resistant substance, but that some other substance is added to the perishable sapwood which converts it into durable heartwood; and may not this substance indeed be 'phlobaphene,' known as red oak and used by fishermen to preserve sail-cloth, which is said to be derived from tannin by further oxidation"?

Furthermore, decay cannot be due to oxidation, since perishable woods may last indefinitely, exposed either to oxygen of the air or of water, and, on the contrary, woods sealed away from oxygen often perish rapidly. It is evidently produced by a fungus and also a microbe, *Bacillus amylobacter,* which attacks the intercellular substance and not the lignin.

In regard to the substantiation of Mr. Stone's hypotheses from a chemist's standpoint, Dr. Hawley has kindly supplied the following comments:

Mr. Stone's article is admittedly a series of suggestions rather than statements of fact. There are few of these which we do not believe to be meritorious and some of the discussions give wrong impressions. For instance, the question, "What is added to the perishable sapwood in order that it may become durable heartwood?" implies that the difference in durability is necessarily due to something *added* to the sapwood. A common opinion is that something has been *removed* from the sapwood to make the heartwood more durable; it is easy to conceive that the liquid sap, the starch, and the other less stable constituents of the sapwood are particularly good foods for the fungi, and it does not seem to be necessary to consider the *addition* of something to sapwood to make it more durable.

The suggestion that phlogaphenes are accountable for the greater durability of heartwood is not convincing, for the following reasons:

(1) Only a few species of trees have large enough amounts of phlobaphenes to make any difference in the durability of the wood unless phlobaphenes are extraordinarily toxic.

(2) There is no evidence that phlobaphenes are any better preservatives than tannin; in fact, we should expect them to be *less toxic*, since they are more inert chemically and less soluble.

The phlobaphenes, which are anhydrides, *not oxidation products*, of the tannin, form a series containing less and less water, the first of the series often being indistinguishable from tannin and the others becoming more and more insoluble.

Mr. Stone's reasoning in one place is certainly ingenious. He had previously spoken of the disappearance of lignin as accounting for most of the reduction in weight of decayed wood and now says: "The durability of wood is in proportion . . . to the amount of lignin, for the more there is, the longer it will naturally take to perish." This is the same as reasoning that a block of mixed sugar and sand will withstand the action of water longer the greater the proportion of sugar present, because the more sugar there is, the longer it will take to dissolve it.

The implication that lignin is more liable to decay than cellulose is also not warranted. Even in the first part of the same article attention is called to a statement by Margell that "every fungus calls forth a specific form of decay," and the recent work of Reseahisse[1] and Palmer[2] indicates that some fungi attack the cellulose more rapidly than the lignin.

Hypotheses may sometimes be easier to proclaim than facts, yet to the person with vision to see a possible interpretation of a conglomeration of facts a hypothesis, even though incorrect, is of first value; and this article of Mr. Stone's is illuminating, even though his assumptions are not well founded. H. D. T.

"The Durability and Decay of Wood." *Timber Trades Journal* (London), June 7, 1919.

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[1] Jour. Ind. and Eng. Chem., vol. 9, pp. 284-7 (1917).
[2] Unpublished report, Forest Products Laboratory.

POLITICS, EDUCATION, AND LEGISLATION

Greater Democracy in Prussian Forest Service

Prussian forest officers of the lower grades (Förster) see better times for their class as a result of the revolution. They have been working up to now under the code of instructions drawn up in 1868—a code which does not in any way fit present conditions, and in connection with which they had many grievances, concerning such matters as annual leave, hunting privileges, rights to firewood, damages by game to their gardens, etc.

Just before the revolution a new set of instructions was drawn up by the central office, without consulting the officers concerned, but had not been issued. Because of the protests by the foresters' union, or because of the revolution, or because of both, it has now been decided to allow the foresters themselves to take part in formulating their code of instructions.

"Forestry, one of the fundamental factors through which the people, enfeebled by the hard times of the lost World War, will in the course of time become strong again, must have an intimate share in the rebirth of the Empire. . . . No one who carefully and impartially studies the events of the disastrous great war, which nevertheless it is to be hoped will be productive of great good, can or will ever believe that bureaucracy and the discipline of force can ever again in any way prevail with the German people." W. N. S.

Die Neue Försterdienstanweisung in Preussen. Deutsche Forstzeitung 34: 1-2. January 5, 1919.

Organization of a Bavarian Forest-owners' Society

Forest covers 2.5 million hectares in Bavaria and is worth approximately 7.5 billion marks. State forests comprise but 33.6 per cent of the total area. Recognizing the importance of organizing private forestry so as to develop to the utmost the productivity of the country, a society of private owners has been formed with the object of organizing forest production on the entire area of privately owned forest. The following measures are to be undertaken: (1) Advocacy and support of the mutual interests of members in matters of legislation and regulation; (2) formation of forest co-operatives, with advice and assistance to members in all branches of forest practice and regulation; (3) assistance in the carrying out and revision of

working plans and estimates; (4) designing of and expert advice for industrial undertakings and transportation projects; (5) promotion and development of all forest and forest industrial establishments; (6) co-operation in getting and placing of officers, subordinates, and laborers, as well as promotion of individual insurance; (7) holding of courses of instruction in forestry.

The most pressing tasks of the society will be forest—political in nature, concerning matters to which the war has given rise. Such are questions of taxation, railway transportation, management during the transition period, and the tariff. W. N. S.

Naturwissenschaftliche Zeitschrift fur Forst and Landwirtschaft. 16: 286-287. 1918.

EDITORIAL COMMENT

The somewhat sharp arraignment of the lumber industry by Mr. Olmsted printed in an earlier issue of this volume (page 222) has, as was to be expected, given rise to sharp rejoinders in the lumber trade press. Notably an article by Charles S. Keith in the *Lumber World Review* of June 20, and another by C. S. Smith, read before the California Section of the Society and published in *The Timberman* for June, give expression to a sore or perhaps only resentful feeling of the objurgations against the lumberman's fraternity. We do not believe for one moment that any "malice," as Mr. Keith has it, actuated Mr. Olmsted, and it was only to force attention that he used forceful language in pointing out that a national forest policy must include regulation or control of the exploitation of private timber lands.

Meanwhile Colonel Graves did well by bringing this subject, the formulation of a national forest policy, prominently before the National Lumber Manufacturers' Association at its annual meeting in April, following up the resolution adopted at the last annual meeting of the Society of American Foresters. This was followed by a conference at Washington in May, where constructive measures were discussed mainly by State foresters of Eastern States. The sense of the meeting was expressed in one resolution:

> *Resolved*, that forestry questions are national questions, as well as State and local questions, and it is the sense of the conference that the National Government should assume leadership in these matters and aid and co-operate with the several States in furnishing adequate protection from forest fires, in perpetuating existing forests, and in reforesting devastated forest districts or regions, upon such conditions as may seem just and equitable.

Similar conferences were called to Harrisburg, Pa., and Asheville, N. C., and discussions on the same subject also took place at other Society meetings, and a special committee of the Society is at work toward formulation of such a policy.

The lumber trade papers have also been active in the discussion of the important problem. Among other articles, we note one by E. A. Sterling which makes a financial showing to demonstrate the unprofitableness of intensive forestry. Placing the cost of the needful 200,000,000 acres at $6,000,000,000 and demanding an interest rate of 4 per cent, placing the stumpage value for eastern woods at $12, of Pacific Coast wood at $6, he works out a deficit of $57,000,000,000 annually.

The rejoinder is that stumpage values will be very much higher before a long time and 4 per cent a higher rate than may be used in compounding. Assuming the stumpage value at $12 all around, the deficit is changed into profits.

Colonel Graves in his original address laid the accent on regulation of the operations of private owners and corporations with the same. We quote his conclusions as to the character of the co-operation:

It would be the aim to establish a minimum requirement which would apply to all timberland owners. There would be, first, definite requirements as to fire protection. Necessarily these would vary somewhat as between regions, but they would be substantially uniform within given economic forest units. They would be carefully worked out as a part of the organized protective system for the State.

There would also be minimum requirements as to methods of cutting. The aim would be to make provision for natural reproduction of good species to follow lumbering. The method necessary to secure such natural reproduction will necessarily be simple and within the possibilities of practical application.

Co-operation with owners would be designed to overcome the obstacles that are faced by individual owners who undertake unaided to practice forestry. This co-operative aid would ordinarily fall within the following classes:

1. Aid in fire protection. This would be similar in principle to that already in existence in several States. As the requirements and standards would be greater under the new plan, so also would the financial and administrative co-operation be greater.

2. Land classification. Any plan of requirements as to forest replacement involves classification in order to determine the lands that should remain under forest. Such a classification is very practical, as is shown by the fact that the Forest Service completed a similar classification of 150,000,000 acres of National Forests in about five years.

3. Establishment of a system of taxation that levies a reasonable annual tax on the land, but collects the main tax on the timber when it is cut.

4. Co-operation in technical methods of forest-work through the advice of experienced men in the public service.

5. Aid in securing long-term loans at low rates of interest, through a credit system similar to that of the Federal loans to farmers.

6. Industrial co-operation. This may take a variety of forms. It may involve labor problems, domestic trade relations, exports, tariffs, encouragement of sound trade methods, industrial research, diffusion of useful information, etc.

7. When public and private forests are adjacent or interlock, it may be desirable to work out co-operative or joint undertakings, under adequate safeguards of public control, to insure an economic development, a sustained production of materials for the local industries, and the permanence of the communities with the opportunities for sound community life.

While we would employ every method that promises results ever so little, we take the position that the control of private forest management is surrounded with such difficulties that no early and satisfactory re-

sults may be expected from that quarter, if for no other reason than the naturally inimical attitude of the forest owners.

We say naturally, because of the inherent unsuitableness of the forestry business to private enterprise. Without arguing this position at length, we have formulated twelve simple, fundamental, commonplace truths which lead to our conclusion:

1. Forestry—the growing of wood crops *as a business*—is based upon the presumption that wood will be *always a necessary raw material* in our civilization and that its present uses and methods of use will continue. It is a speculation in futures.

2. Forestry—the growing of wood crops *as a business*—requires a small amount of labor, a large amount of capital, and a long time for its product to mature. This last requirement distinguishes it from all other industries. It involves compound interest calculations for a long time, speculations for a long-distant future.

3. Forestry *as a business* may be profitably carried on only on *large-sized areas, under one management,* in order to furnish a sustained yield of sufficient amount annually. This applies especially where home markets are not developed.

4. Proper economic considerations demand that agriculturally fit soils be reserved for food production, leaving the *poorer sites* for forestry use. This condition reflects disadvantageously upon the unit-area production and also on all the financial aspects of the business.

5. Financially, forestry means foregoing present revenue or making present expenditures for the sake of future revenue. Forestry is *profitable only in the long run,* and the long run means on so-called absolute forest soils, as a rule, not less than 50 and up to 150 years.

6. These fundamental conditions of the business of forest-growing render it *unattractive to private enterprise,* which looks for immediate or near-by results. Only large, long-lived corporations and industries, like paper manufacture, with heavy investments in operating plants, relying on a continuous supply of raw material, may be an exception.

7. The interest in forestry of the community, of the municipality, and of the State is threefold, namely, in the assurance of continued supplies for wood-using industries, in the influence of forest cover on water conditions, and in the utilization of all land areas to the best advantage.

8. This threefold communal interest establishes the right of the community to prevent misuse and to control the handling of private forest property at least to the extent of protecting itself against damage in the three directions just named, of preventing its abuse and turning productive into waste lands, and possibly, also, but questionably, enforcing silvicultural measures.

9. Silviculture—the art and operation of securing reproduction of wood crops—is based largely on empiricism, and its methods vary according to local conditions and judgment. No two foresters may agree on procedure in a given case, and yet both may be successful. It is therefore impracticable to prescribe siliviculture procedure with assurance and it is also difficult to impose and control such procedure.

10. Siliviculture success depends on the combined effect of soil, climate, weather, and size of operation. While financial considerations favor large con-

tiguous felling areas and rapid exploitation, silvicultural considerations necessitate small, disconnected felling areas and slow removal of the mature crop, especially if natural regeneration is to be relied upon. Hence accessibility of every part of the forest property, involving large capital outlay, is a silvicultural necessity.

11. Natural regeneration, while apparently cheaper than artificial reforestation because not requiring direct visible outlay, entails slow—that is, expensive—removal, waiting for seed years, and luck in weather, while artificial regeneration can be forced to success, but requires definite capital outlay.

12. All points considered, forestry as a business can successfully be applied only or mainly by the community, municipality, or State. Public ownership and operation, rather than control of private forest management, recommends itself on account of the inherent conditions of the business and the difficulty of devising and enforcing methods of control.

Breaking off for the present the discussion of this great subject, we do not want to leave it without referring our readers specially to the review of the British Reconstruction Commission Final Report, printed in this issue, which elaborates a forest policy for Great Britain and is most suggestive for us at the present juncture. B. E. F.

NOTES

The Requirements of Certain Forest Trees [1]

Hutchinson has brought together much valuable material. His aim has been to give the limiting factors (temperature, water, soil, etc.) in the specific requirements[2] of certain forest trees with regard to each of these factors, and thereby to account for the respective distributions of some of the trees dominating the forests of Ontario.

The most interesting part of the paper is its five diagrams. Each diagram gives the range of the requirements of a number of forest trees for a single important factor. For example, the first diagram gives the relative requirements of fifteen forest trees in temperature. The diagrams are relative rather than quantitative, because quantitative data are lacking. It is, however, of no little interest to have the relative requirements of these forest trees assembled in one place.

The method of constructing the diagrams appears to be comparatively simple and the diagrams can be understood without undue expenditure of time. The range of requirements for any given species and factor is represented by a semicircle. The radius of the semicircle represents the magnitude of the range of the species for the given factor. For example, in the diagram of water requirement, *Acer saccharum* comes higher up on the scale than *Pinus strobus,* and has a considerably shorter radius, and therefore smaller semicircle, than *Pinus strobus.* The *Pinus strobus* semicircle includes in its upper part almost the entire area of the *Acer saccharum* semicircle and extends away below the latter. This means that white pine can stand almost as much water as sugar maple and can grow with far less.

There is a diagram of specific requirements (called "specific tolerance") for each of the four following factors: temperature, water, soil development (see discussion of soil diagram below), and intensity of light. The fifth diagram combines in one the temperature, water, soil, and light requirements of two competing species, *Abies balsamea* and *Acer saccharum.* In this diagram the competition of the two trees

[1] A. H. Hutchinson: "Limiting factors in relation to specific ranges of tolerance of forest trees." Bot. Gaz., Vol. 66, No. 6, pp. 465-493, 2 maps, 5 diagrams, December, 1918.

[2] Hutchinson uses the word "tolerance" instead of requirement. This appears to the reviewer confusing, especially in the paragraph on light, where he uses the terms "light tolerant" and "shade tolerant" in the same sentence.

is shown graphically by shading those areas where semicircles for a given factor overlap. For example, with temperature, *Abies* is above (north of) *Acer*, but the lower half of the *Abies* temperature semicircle overlaps the upper half of the *Acer* temperature semicircle.

The temperature diagram includes fifteen species and is fairly reliable, as far as the reviewer can tell. *Populus balsamifera* is given the greatest range, with *Betula papyifera* only slightly less and a little less to the north. *Picea mariana* and *Picea canadensis* are equal in extent of range, with the former a little further north. *Pinus banksiana* is placed a little to the north of *Abies balsamea*, but with a somewhat narrower range. This might be questioned, in view of the southern extension of *Pinus banksiana* along the Rocky Mountains.

The diagram for water requirements gives thirteen species, some of which are not found in the temperature diagram. *Larix americana* is given by far the greatest range, including all the others, except for insignificant areas of the *Populus tremuloides* and *Pinus banksiana* semicircles in the dry end of the scale. The relative position of the remaining species appears to be about that which one would expect, with the possible exception of *Tsuga canadensis*, which is placed below *Fagus americana*, *Acer saccharum*, and *Picea canadensis* in water requirement.

It is when we come to the diagram of soil requirements that Hutchinson fails. He covers only the physical properties of soils, chiefly as influenced by the proportion of humus in mixture. This is due to Hutchinson's acceptance of the dogma that the composition of the soil (the chemical elements which it contains) is of itself unimportant. The diagram is therefore limited to "soil development." By this he appears to mean the degree of disintegration and proportion of humus, starting with rock particles devoid of humus and ending with a soil "well drained, well aërated, and containing a relatively large amount of humus intimately mixed with the rock soil," which he terms "mature soil." The conception of soil development is sound. But Hutchinson deliberately ignores the fundamental principle that different rock formations do not develop similar soils. They may, and often do, develop soils which are similar in physical properties; but similar physical properties do not mean similar fertility or the ability to support the same type of vegetation. Burd[3] has found "great variation in yields and water extracts between individual soils in a (physical) type which is probably unusually uniform." Burd's work is a striking laboratory

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[3] John S. Burd: "Chemical criteria, crop production, and physical classification in two soil classes." Soil Science, Vol. 5, No. 5, pp. 405-419, May, 1918.

confirmation of what Fernald[4] so earnestly advocates as the result of field investigation—recognition of differences in chemical properties. and of the influence of these differences on vegetation.

The diagram of soil development, therefore, has a serious limitation. Considering it as representing only soil requirements with regard to physical properties and humus content, the diagram has its value. It shows that beech and sugar maple come at the stage of highest soil development (that is, when considerable humus has accumulated) and have the smallest extent of range. His placing *Tsuga canadensis* with beech and sugar maple, only slightly below them and with a slightly greater range, may be questioned. In Connecticut and New York hemlock thrives on the rockiest talus slopes—obviously very early stages of soil development—provided there is sufficient moisture from underground seepage. He omits *Pinus banksiana* altogether from the diagram and places *Thuja occidentalis* next to lowest (earlier stage of soil development) with a comparatively small range. Thirteen species are presented.

The diagram of light intensity also gives thirteen species, though not all the same ones as in the soil diagram. With a few exceptions, the order is about the same as that in the lists of shade tolerance prepared by foresters. The most noticeable exception is the placing of *Abies balsamea* among the intolerant trees, making it less tolerant of shade (or tolerant of higher light intensity) than *Quercus rubra*, *Ulmus americana*, or *Betula lutea*. Tolerance in Ontario is probably different from tolerance in northern New England and New York, but can it be as different as this? It is also somewhat surprising to see *Picea mariana* classed as less shade tolerant than *Ulmus americana* and *Betula lutea*.

The discussions of the individual factors (temperature, water, light, etc.) consist largely of quotations and leave much to be desired. The soil factor is again particularly poor; he ignores everything but physical properties.

The humus factor is discussed almost wholly from the point of view of the influence of humus on physical conditions. He seems to ignore the influence upon growth of the nitrogen contained in the humus.[5]

His explanation of the cause of the northern coniferous region and

[4] M. L. Fernald: "Lithological factors limiting the ranges of *Pinus banksiana* and *Thuja occidentalis*." Rhodora, Vol. 21, No. 243, pp. 41-67, March, 1919.

[5] Hesselman: "Studier över de Mörrlandska Tallendarnas Foryngringsvillkor: II. Meddlanden Frän Statens Skogsförsöksanstalt," pp. 1121-1286, 1917 (Swedish Exp. Sta.). Review by G. A. Pearson, Jour. For., Vol. 17, No. 1, pp. 69-73, 1919; also in Jour. For, Vol. 16, No. 8, pp. 937-938, 1918. This paper shows that reproduction is prevented in certain openings by the lack of nitrogen.

northern hardwood region is good. The differentiation between these two regions is, he says, due to differences in soil. Whether or not the soil differences are merely due to differences in weathering, as he appears to assume, is another matter.

Hutchinson's errors in tree ranges have been sifted out by Fernald in his paper on "Lithological Factors."[6] These errors are chiefly due to Hutchinson's acceptance of the theory that "the composition of the rock from which any soil may be derived seldom acts in a limiting capacity with respect to the species which that soil may support." This dogma, unfortunately, all too generally accepted by ecologists, leads Hutchinson into error, particularly in the ranges of Jack pine (*Pinus banksiana*) and white cedar (*Thuja occidentalis*). As a natural corollary, it makes him give mistaken explanations of so-called "irregularities" in these ranges—"irregularities" which become perfectly regular when one recognizes that jack pine does not grow on limestone formations, and that white cedar is largely confined to calcareous soils.

On the whole the paper contains much of interest. It would be a mistake to condemn it entirely because of a false viewpoint toward one of the factors which it considers. The specific requirements of forest trees for temperature, water, soil, and the other factors which control the life of the forest must be studied as a basis for sound silvicultural practice. Hutchinson has made a beginning in collecting some of this important material. As such, and for the stimulus which his work will give to further studies along this line, his paper is of value.

BARRINGTON MOORE.

SOIL REQUIREMENTS OF JACK PINE AND WHITE CEDAR[1]

Fernald's paper, "Lithological factors limiting the ranges of *Pinus banksiana* and *Thuja occidentalis*," together with his paper on "The contrast in the Floras of Eastern and Western Newfoundland"[2]—a contrast due to the limestone in western and acidic rocks in eastern Newfoundland—marks a turning point in ecology. Hitherto most studies of the factors controlling vegetation have been started on the assumption that climate dominates, almost to the exclusion of all other influences save fire. I am classing topography and elevation under

[6] M. L. Fernald: "Lithological factors limiting the ranges of *Pinus banksiana* and *Thuja occidentalis*." Rhodora, Vol. 21, No. 243, pp. 41-67, March, 1919.

[1] M. L. Fernald: "Lithological factors limiting the ranges of *Pinus banksiana* and *Thuja occidentalis*." Rhodora, Vol. 21. No. 243, pp. 41-67, March, 1919.

[2] M. L. Fernald: "The contrast in the floras of eastern and western Newfoundland." Am. Jour. Bot., Vol. 5, No. 5, pp. 237-247. 1918.

climate because the north aspect or higher elevation influences vegetation through increased moisture, diminished temperature, or differences in wind exposure. Undoubtedly climate includes the dominant set of factors, and where climate changes radically in short distances, as it does in the mountainous regions of the West, climatic influences is more noticeable. Where the climate is fairly uniform over large areas, as in a large part of the East, the differences in vegetation are largely due to soil. This condition has been too often ignored, with consequent mistakes and confusion.

Fernald presents convincing evidence of the importance of the chemical composition of the soil. With precise detail he gives the occurrence of jack pine (*Pinus banksiana*) and of white cedar (*Thuja occidentalis*) and the character of the geological formation on which each is found. Jack pine is confined to formations without lime; white cedar, on the other hand, grows best on limestone. On soils deficient in lime it grows poorly or not at all. He states (page 63) that "*Thuja occidentalis is almost as pronouncedly calcicolous as Pinus banksiana is calciphobious.*"

Fernald lays great stress on the importance of recognizing the distinction between plants which grow on lime soils and those which grow on soils without lime. He quotes Praeger's Irish Topographical Botany, saying: "The presence and absence of lime is the most important particular in which petrology affects the distribution of plants. "Why," asks Fernald, "is this almost axiomatic law blindly ignored or only grudgingly admitted by so many American physiographic ecologists and phytogeographers?" The answer is not far to seek. The ignoring of this axiom is based on a fixed idea, and nothing is more difficult than to change men's views toward an idea which has taken root. A new discovery they will readily accept, but an old theory based on half truths they cling to tenaciously.

There is such a theory which holds that soil is of little or no importance except in so far as its physical properties, coarseness or fineness, are concerned. For this we have to thank, it seems, the Milton Whitney school in the Bureau of Soils. Physical properties are important, but the fertility of the soil in many cases varies greatly without corresponding variation in the physical properties.[3] Not until the soil is studied from the chemical and biological as well as the physical point of view will the relations between natural factors and vegetation—plant ecology—begin to be adequately understood.

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[3] John S. Burd: "Chemical criteria, crop production, and physical classification in two soils." Soil Science, Vol. 5, No. 5, pp. 405-419, May, 1918.

Perhaps the most important inorganic chemical constituent, so far as plants are concerned, is lime. At least the presence or absence of lime seems to produce a more noticeable difference in the vegetation than the presence or absence of other inorganic elements. By all odds, the clearest and most reasonable hypothesis of the lime relation which the reviewer has seen is that of Truog in his "Soil Acidity: I—Its relation to the growth of plants." [4] In this he not only shows that each species of plant has its own specific lime requirement, and why this is so, but gives a table of the relative lime requirements of some of the more important plants, including several forest trees.

Fernald vigorously attacks the "dogma," as he calls it, that ignores the influence of soil and rock formation outside of physical properties. He has no mercy on the mistakes into which Prof. A. H. Hutchinson[5] is led through adherence to this dogma and blames Clements for propounding the same theory. He leaves us with a definite impression, and undoubtedly one which is fully justified, that failure to recognize the influence soil factors, in particular the lime content, and to understand the soil requirements of plants has retarded the development of ecology.

BARRINGTON MOORE.

NOTES ON REPRODUCTION OF WESTERN YELLOW PINE IN ARIZONA

An exceptionally heavy seed crop of western yellow pine on the Coconino and Tusayan Forests in 1918, followed in 1919 by one of the rainiest summers on record, has resulted in a seedling crop such as has not been witnessed before since these Forests came under the administration of the Forest Service. This situation has given rise to an unequaled opportunity for the study of natural reproduction. Investigations have shown that in virgin stands the number of seedlings per acre in the openings is 100,000 to 150,000; in standard Forest Service cuttings the number is 20,000 to 50,000, depending upon the size of openings, while on areas bearing only one or two seed trees per acre the number is usually less than 2,000. Another interesting observation is the occurrence of local areas where the seed crop in 1918 was light, as indicated by the small number of cones on the ground. In such cases the seedling crop is invariably light.

Naturally forest officers are speculating as to the ultimate result of

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[4] Emil Truog: "Soil acidity: I—Its relation to the growth of plants." Soil Science, Vol. 5, No. 3, pp. 169-196, March, 1918.

[5] A. H Hutchinson: "Limiting factors in relation to specific ranges of tolerance of forest trees." Bot. Gaz., Vol. 66, No. 6, pp. 465-493, December, 1918.

this seedling crop. If climatic conditions continue favorable through 1920, a large percentage of the seedlings will become established; but if we should have a severe season, nearly the entire crop may be destroyed. Unless climatic conditions during the next year or two are such as to completely overshadow other factors, an unparalleled opportunity will be afforded for the study of survival as related to influence of the mother stand, brush disposal, grazing, and the character of the soil. G. A. P.

The Post-Office appropriation act, besides increasing by $200,000,000 the total fund available under the Federal-aid roads act, makes available for expenditures by the Secretary of Agriculture $9,000,000 for roads and trails within or partly within the National Forests, and also authorizes the Secretary of War to transfer to the Secretary of Agriculture material, equipment, and supplies suitable for highway improvement and not needed by the War Department, of which not to exceed 10 per cent may be reserved by the Secretary of Agriculture for use in building National Forest roads or other roads constructed under his direct supervision.

The $9,000,000 fund may be used for maintenance as well as survey and construction. The new legislation, like the Federal-aid roads act, makes the building of roads and trails necessary for the use and development of National Forest resources or desirable for the proper administration, protection, and improvement of any Forest contingent upon co-operative local contribution; but in addition contains a new feature of much importance, which permits the Secretary of Agriculture, without the co-operation of local officials, to build and maintain "any road or trail within a National Forest, which he finds necessary for the proper administration, protection, and improvement of such Forest, or which in his opinion is of national importance."

The New Zealand Department of Lands has published a small book by D. E. Hutchins on the "Waipoua Kauri Forest," in which occurs the statement: "There were two gigantic Kauri in the Tutamoe State Forest, each having a diameter of 22 feet, and the best one having a clean bole of 100 feet. This was estimated to contain 295,788 board feet, which is twice the size of the largest California big tree, one of the Calaveras grove containing 141,000 board feet."

It is strange that at the present day the claims of California for large-sized trees should be contested by New Zealand. The following data show that even though New Zealand has some immense trees, as

those just described appear to be, still they cannot equal the giant sequoias, of which we are justly proud.

A sequoia tree cut in 1854, called "The Mother of the Forest," had a diameter of 30 feet and a height of 321 feet and contained 537,000 board feet, which is twice that given for these famous Kauri trees of New Zealand. In addition, this tree was 137 feet to the first limb. Another tree, called "The Father of the Forest," measured a number of years ago 36 feet in diameter, 400 feet in height, and 200 feet to the first limb. Bulletin 28 of the Bureau of Forestry mentions 16 trees with diameters of over 22 feet, with an average height of 272 feet, and three trees, named after Eastern States, have diameters of 33, 34, and 35 feet and heights of 307, 311, and 300 feet. John Muir, in his "Mountains of California," mentions that he measured a tree in the Kings River Forest which had a diameter of 25 feet at the ground and a diameter of 10 feet 200 feet from the ground, with 100 feet or more of the trunk branchless. It is not often that one comes across such statements as the one by Mr. Hutchins, but when we do we are greatly chagrined that our fame has not yet permeated to the ends of the earth.

E. N. M.

In the *Comptes rendus des Séances de l'Académie des Sciences* for May, 1918, a process for making paper pulp from leaves is described as simple, rapid, and inexpensive. The leaves are crushed, and thus divided into two parts, veins and powder, the veins forming the raw material for the pulp. They are steeped in lye for a short time, then washed and bleached, and the pulp is made.

The powder may be used as a fuel. It may be compressed into bricks with or without coal dust, but dry distillation is preferable. By this method is obtained a relatively pure (porous) fuel, rich in calories (6,500 to 7,000) and easily agglomerated. At the same time are obtained a tar, acetone, and pyroligneous acid. The powder may be used as a food for cattle also; for, the fibrous parts of the leaf having been removed, the assimilable, nutritive parts remain.

The yield of 1,000 pounds of leaves is: 250 pounds of paper pulp; 200 pounds of pure fuel (or 500 pounds of food powder); 30 pounds of tar, 1 pound of pyroligneous acid, 0.6 pound of acetone.

To meet the paper requirements of France, only 4 million tons of the annual supply of from 35 to 40 million tons of dead leaves would be necessary, which would, moreover, yield 2 million tons of useful by-products. The leaves are easily collected and need not be stored, as they may be utilized throughout the year. It would be better to

install works near the large forests where the raw material could be collected as required, though the leaves might be transported in compressed form.

A new department of Forest Recreation has been established at the New York State College of Forestry, Syracuse University. Professor Henry R. Francis will have charge of this department. During the past five years he has been carrying on landscape extension work both in New York and Massachusetts. This summer he was to begin systematic studies of forest and park areas in New York to prepare bulletins for recreational development, and later in the season was to make a trip through the National Forests and National Parks of the West to see what has already been done by the National Government and by the Western States in developing the recreational possibilities of forest lands.

The Laurentide Company, which was the pioneer in grinding hardwood for pulp in an experiment last fall, tried a further one this spring when seventy cords of mixed birch, beech, and maple were barked in the drum barkers without any difficulty and ground into pulp. Owing to the irregularity of the four-foot sticks, barking with knife barkers was proved to be unsuccessful, but the drum barkers removed the bark, if anything, a little more easily from the hardwood than from spruce: the only difficulty was the weight of the wood, which is harder on the conveyors. Beginning in August, the company was to use hardwood continuously.

An airplane expedition to ascertain the value of the wood-pulp resources of Labrador sailed from New York on July 7 for Newfoundland. The party of 40 was headed by Captain Daniel Owens, who served in the war with the British Air Force. It was planned to take aërial photographs of all large forests and from these to calculate the value of the pulpwood. Four airplanes were to be used in the undertaking. By this method it will take about six weeks to do what would ordinarily require five or six years.

Prior to the war the quantity of Sitka spruce logs annually manufactured into lumber of all grades in British Columbia did not exceed 3,000,000 board feet, only 150,000 board feet of which would have been

suitable for airplane construction. No fir of the grade suitable for airplane construction was manufactured in British Columbia prior to the war, and special methods of manufacture were instituted to develop this entirely new grade. The total outlay in connection with the production of airplane spruce and fir in British Columbia was approximately $8,200,000.

A proclamation creating the Alabama National Forest has been signed by the President. About 10,500 acres of public lands, in Lawrence and Winston counties, in the northern part of the State, which had been withdrawn from entry, are included in the new National Forest. In addition, the Government has purchased approximately 12,000 acres and has options on an additional 13,000 acres in the same locality. It is expected that by further purchases the Forest will eventually be enlarged to include about 150,000 acres.

Roland D. Craig and staff are engaged on a forest survey of the Province of Ontario on which the Commission of Conservation and the Province of Ontario are co-operating. The survey, similar to that of the Province of British Columbia, has in view the securing of reliable estimates of the standing timber and pulpwood of the Province, its location, distribution of species, etc., and data and maps showing the area covered by forests, the areas suitable for agriculture, waste lands, and the areas which should be devoted to production of forests.

The name of the College of Forestry of the University of Washington was lately changed to the College of Forestry and Lumbering, the work having recently broadened out to include almost every aspect of the lumbering industry, in this respect differing from that of other forest schools. In addition to the subjects usually found in a forestry curriculum, Washington offers opportunities for specialization in general forest products, logging engineering, and the business of lumbering, the latter including new courses in milling and marketing.

The Mexican Government has established a National Forestry School at Coyoacan, Federal District. The school was opened on March 1, 1919, admitting students from all the States. The course of instruction will cover a period of three years. The forest areas of Mexico are very large, but up to the present no scientific regulations or knowledge

have been applied to the cutting of the timber. Reforestation of the more barren sections of the country is also contemplated.

According to a report of the Director of the Bureau of Forestry of the Philippine Islands, the raw materials available for paper manufacture, such as the bamboo and two kinds of grasses, the cogon and the talahib, are of such good quality and can be so cheaply obtained that the islands should not need to import annually two million dollars' worth of paper, but should in time be in position even to export large quantities of newsprint.

A United States Forest Service ranger has devised for the use of lookouts a simple eye protector to protect the eyes against the bright glare in the atmosphere at high elevations. It is made of cardboard, painted black, fitting over the eyes, and has a long horizontal opening lined with narrow strips which prevent the entrance of light from the sides; also from above and below. A test was to be made this summer by several lookouts.

The Forest Products Laboratory at Madison, Wisconsin, during the war developed a rapid method of seasoning oak, the time for which was reduced from two to three years of air seasoning of heavy oak wagon stock to 90 or 100 days for three-inch material green from the saw. Three large plants using this system record negligible losses and as compared with losses at plants using other methods ranged from 10 per cent up to complete loss.

The names of W. S. Moir and H. M. Meloney, students at Yale Forestry School and New York State College of Forestry at Syracuse University, respectively, are announced among those of ten American college students to receive $1,000 each from the American-Scandinavian Foundation to enable them to go to Sweden to study in exchange with ten Swedish students to come to America.

The Dominion parks of Canada, which are maintained as wild-life sanctuaries, include an area of 7,927 square miles, or more than 5,000,000 acres, nearly equal to one-half the total area of Switzerland, almost as large as Belgium, and nearly 1,000 square miles greater than the area of Wales.

The New York State Forestry Association has begun the publication of a quarterly journal under the title *New York Forestry*. J. R. Simmons, Secretary of the Association, is the editor, located in Syracuse. In the first (July) issue we miss the serial number, and all reference to the Association affairs. The number opens with an optimistic address by Professor Roth.

Minnesota is to have a forestry appropriation of $85,000 this year—not more than $10,000 to be spent for reforestation, not more than $12,000 for administration, and the balance, $63,000, for forest fire prevention and protection. The appropriation two years ago was $50,000.

British Columbia's timber output in 1918 was valued at $54,162,523—almost double that of 1915 and 12 per cent greater than that of 1917. The total production for the year was shown as 1,545,422,000 feet. Since 1915 the lumber cut has increased over 50 per cent.

The latest proposition for cheapening lumber transportation from the Pacific coast is a self-propelling, demountable raft, put together by bolts, in the shape of a freighter, provided with engine and quarters for crew and possibly other freight.

Dr. Philip W. Ayres, Forester of the Society for the Protection of New Hampshire Forests, has been elected President of the Appalachian Mountain Club, the first forester to fill the office. The members of the club number over 2,000.

H. R. MacMillan, formerly head of the British Columbia Forest Service, has been appointed representative of the British Timber Buyer in Western Canada, with offices in Vancouver, British Columbia.

SOCIETY AFFAIRS

Can the President of the Society Express His Personal Views?

At the summer meeting of the New York Section of the Society the following resolution was passed: "That the Secretary of the Section communicate to the Secretary of the parent Society its feeling that the President of the Society should not have expressed personal views in articles published over his official title, which may be construed as representing views of the Society as a whole."

Since the article to which exception is taken in this resolution appeared in this Journal (page 227), some of the responsibility for its form falls upon the editor-in-chief. Unfortunately, by accident, the article did not come to the cognizance of the editor before it was in print. If, however, it had in the usual manner come before him he might have asked permission of the author to modify the somewhat unparliamentary expressions, but it would never have occurred to him to question the propriety of the author's using his official designation as President of the Society, especially as the article was evidently addressed to the members of the Society in his official capacity, not as an expression of the opinion of its members, but as a call for taking a certain attitude.

The editor agrees entirely with the rejoinder of President Olmsted, printed below, in his reply to the Section. B. E. F.

August 30, 1919.

Mr. A. B. Recknagel, *Secretary,*
New York Section, Society of American Foresters, Albany, New York.

Dear Recknagel:

At first I was inclined to believe that your letter of August 1 to Mr. Kelleter did not call for an answer. It occurs to me now, however, that I should make it clear in very few words why I am quite unable to agree with the feeling of the New York Section to the effect that I should not have expressed personal views, in an article under my official title, which might be construed as representing the opinion of the Society as a whole.

My article on "The Work Ahead" was an address to foresters, lumbermen, and the public, and purposely expressed my views as President of the Society. I stood for my personal views in my official capacity, as any executive is bound to do. It is perfectly true that the views I expressed may or may not be those of the Society as a whole, but that is entirely aside from the point. The article reflected simply my own views as President and in no way implied that they were the

views of the Society as a whole. I cannot imagine an executive officer so timid as to exclude his personal beliefs from his official addresses.

I should be greatly obliged if you would bring this letter to the attention of the members of the New York Society.

Sincerely yours,

F. E. OLMSTED,
President, Society of American Foresters.

Society Pins

Pins indicating membership in the Society of American Foresters may be obtained through the Treasurer at a cost of $4.20 each. This charge covers delivery and war tax.

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Vol. XVII DECEMBER, 1919 No. 8

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JOURNAL OF FORESTRY

Vol. XVII DECEMBER, 1919 No. 8

The Society is not responsible, as a body, for the facts and opinions advanced in the papers published by it.

THE LINES ARE DRAWN

By Gifford Pinchot

The continued misuse of forest lands privately owned has now brought about a critical situation in America. The conversion of productive forest lands into idle wastes is dangerous to our economic and social welfare. Already it has begun to work a distinctly measurable hardship upon every citizen. It is wholly irrelevant to discuss at just what particular time in the future our remaining supplies of virgin timber will have been exhausted, for the pinch comes long before complete destruction. As a matter of fact, it is here now, in the form of a shortage of wood, with accompanying high prices, and the public pays the bill. The situation demands action, not talk, and the only problem before us is to decide what sort of action is the best.

I shall not review the facts, for these are most excellently stated in the report of the Committee for the Application of Forestry in this issue of the Journal. The gist of this report is that destructive lumbering on private timberlands is working a grave injury to the public interest and must be stopped. A plan to stop it is proposed. The report shows concisely how the public interest is injured: the principles upon which its recommendations are based are to my mind incontrovertible; and the legislation suggested is workable, comprehensive, and fair.

The degree of public regulation proposed is decidedly mild when compared with the tremendous changes in the structure of industry now gradually assuming definite form throughout the whole world. The conclusions were reached after four months' study of the conditions, and the report was written by the members of the committee, not by its chairman. I agree with the findings and recommendations from start to finish. These men have rendered a service to forestry in America which will long be remembered.

The fight to conserve the forest resources of our public domain has been won. The National Forests are now so firmly established and

their management so thoroughly approved by the public in general that any attempt to turn them over to private ownership would only result in extending the policy of public ownership.

Another and a bigger fight has now begun, with a far greater issue at stake. I use the word fight, because I mean precisely that. Forest devastation will not be stopped through persuasion, a method which has been thoroughly tried out for the past twenty years and has failed utterly. Since otherwise they will not do so, private owners of forest land must now be compelled to manage their properties in harmony with the public good. Pressure from without, in the form of public sentiment, crystallized in compulsory nation-wide legislation, is the only method that promises adequate results. To apply this method successfully means to fight.

There is a small minority of progressive lumbermen who are broad-minded and far-sighted enough to realize that destructive lumbering must cease and that the private owner must shoulder his share of the load. These men will support a reasonable program to that end, provided all lumbermen are placed upon a uniform basis when the change is made. Foresters will welcome such support without reserve. The lumber industry as a whole, however, is so constituted and inspired that a change from within is not to be expected.

With the publication of this report, every forester in the country must face a clear-cut issue. He must act either with foresters for the public interest, or with lumbermen for a special interest. By this I do not mean that he must necessarily support the plan advanced by the Committee for the Application of Forestry, or any other particular plan. I do mean, however, that he must actively support and fight for some plan aimed directly at the prevention of forest devastation on privately owned lands, if he is to call himself a forester in the finest sense of that fine word.

The issue is real and immediate because forest devastation increases with appalling rapidity; because the need for governmental control on private timberlands is now self-evident; because without such control the general practice of forestry in this country will never become a reality; and because unless enough forestry is practiced to prevent forest devastation the danger to our prosperity in peace and safety in war will grow steadily worse. The field is cleared for action and the lines are plainly drawn. He who is not for forestry is against it. The choice lies between the convenience of the lumbermen and the public good.

A POLICY OF FORESTRY FOR THE NATION

By Henry S. Graves

Forester, U. S. Forest Service

A national policy of forestry seeks the protection and beneficial utilization of our present forest resources, the renewal after cutting of forests on lands not needed for agriculture and settlement, the stability of forest industries and of satisfactory conditions for forest workers, and the restoration of forest growth on lands now unproductive and idle.

The public interests in the continuance of forests justify and require direct public ownership of extensive areas, and also participation by the public in working out the problem of protection and renewal of private forests. A program of forestry for the nation should include action by the public through the Government and the States, action by land owners and operators, and the means of uniting the efforts of all for the achievement of a common purpose.

The service of forests is not alone local; it is national as well. For the products are widely distributed without reference to State lines, the industries are engaged in interstate business, and the protective benefits of forests often extend far beyond the localities where they are situated. It is the function of the Federal government to take the leadership in formulating a national economic policy that gives consideration to the relationship of all forests to the industrial life of the country. The central Government alone can bring about concurrent and harmonious action within given regions. Its research and educational work may be directed to the problems of the nation and of regions that comprise more than one State. Representing the whole Nation, the Government can stimulate and guide local action where individual States by their own efforts would fail. The Government can act to organize all agencies affected by the forest problem in a united undertaking to inaugurate and carry out a program of forestry.

The States have not only the function of handling the public forests owned by them, but they have also a direct responsibility in the protection and continuance of private forests. In this, the Federal Government should take part to meet interstate and national problems, to

stimulate action by the States, and to bring into harmony the efforts of the different States. In the problem of private forestry, the Government would work through and in cooperation with the States. The legislation affecting the private owner in the matter of protection and continuance of forests should be by the States. The Government should help the States in formulating plans and developing methods and should give direct assistance in carrying them out. The assistance offered by the Government should be contingent upon the States taking legislative and administrative action to provide for the protection and renewal of their forests.

A national policy must recognize the problems of the private owner of forests. Greater security of forest property from fire, better returns from timberland in the long run, and more stable industrial conditions must be sought. A program in which the public participates and recognizes industrial problems, like taxation, would enable private proprietors to handle their forests in a way that would result not in a public injury but in making these forests serve in building up the localities in which they are situated.

PUBLIC FORESTS

There should be an extensive program of public forests, owned by the Nation, by the States, by municipalities, and, too, by quasi-public institutions and organizations. The public forests today comprise about 25 per cent of the total forest area of the country. They should be extended to include ultimately from 40 to 50 per cent.

In any plan of extensive public holdings, whether Federal or State, provision should be made for returning to the communities a share of the receipts, as is done in the case of the National Forests, or for otherwise compensating them for withdrawing the lands from taxation.

The Federal Government should not only provide adequate support properly to protect and develop its forest properties; it should also rehabilitate, by planting if necessary, the depleted and wasted cut-over and burned lands.

National Forests

The Federal holdings should be extended by purchase, by exchange of stumpage for land, and by placing under permanent administration forest lands now in the unreserved public domain.

The program of acquisition should seek two classes of forest land:

1. Areas needed for the protection of water resources, to prevent erosion, for recreation and other general public purposes. These should include both virgin forests and cut-over lands.

2. Cut-over lands, with the purpose of insuring the production of lumber and other products and of establishing demonstration areas and centers for Federal cooperation with States and private owners.

The present Weeks Law program contemplates the purchase of about one million acres in New England and five million acres in the Southern Appalachians. This program should be completed as fast as is compatible with public financial conditions, and should be extended to include other important areas needed for watershed protection and other general public service. Lands acquired for protective purposes as well as those for lumber production should be distributed through all forest regions of the country.

The acquisition of cut-over lands by exchange for stumpage would serve to consolidate and block out the National Forests of the West. This principle has already been recognized in several special laws applicable to certain Forests.

There are still forest lands in the public domain which should be added to the National Forests. There are several million acres of such lands outside of Alaska. The great forests of the interior of Alaska should also be placed under adequate protection and administration.

State Forests

The States should establish public forests, with the same general objectives as the Federal government, and with special reference to the economic and industrial needs within their boundaries. Many western and southern States still own forest lands received in previous grants from the Government. These should be placed under permanent forest administration, with provision for the settlement of areas suited to agriculture. Lands reverting to the States for taxes or otherwise should, where practicable, be retained and used to build up permanent public forest reservations.

Other Public Forests

Every encouragement should be offered to municipalities to establish public forests or woodland parks. These may be necessary to protect the local water supplies, or to serve as public recreation grounds; and in many instances they may yield products that will

help in a material way to reduce local taxation for schools or public works. Permanent institutions and organizations of a quasi-public character should also be encouraged to acquire forests and handle them on the basis of continued production.

PRIVATE FORESTS

The safeguarding and perpetuation of forests on private lands are possible through an organized system of protection, through the prohibition of destructive processes that produce waste lands, and through the promotion of constructive and entirely practical measures of forestry. The participation, liberal cooperation, and direction of the public in working out the problems involved are necessary for success.

Fire Protection

The objectives of fire protection are:

1. To prevent destruction and injury to standing timber by fire.
2. To safeguard young growth already established within the older timber and on cut-over lands.
3. To promote natural reproduction so far as this can be done by fire protective measures.

Effective fire protection is achieved only through a joint undertaking between the public and private agencies in which all lands, regardless of ownership, are brought under an organized system. Such a system requires:

1. An effective service for preventing forest fires and detecting and suppressing those which may be started. Such a service already exists in a number of States.
2. Improvements needed for the prompt detection and suppression of fires. These include roads, trails, lookout stations, properly located stations for rangers, bases for airplanes when these are used, and so on.
3. Measures to reduce the inflammability of the forests. These may consist in lopping the tops, as is practiced in parts of the East; or burning the brush in piles, as is done in many pine stands on the National Forests; or burning over at the proper season cleared areas, protected by fire lines, as in heavy Douglas fir stands; or felling dead snags, as is required in many National Forest timber sales; or other measures. In some places fire lines may be desirable, as practiced in southern California; or carefully controlled burning at the proper season of strips and selected areas, as is practical

in certain open pine forests. Uncontrolled light burning should be prohibited everywhere.

4. A vigorous campaign of education of the public regarding the danger of forest fires and the need of cooperation on the part of every user of the woods.

5. A systematic campaign of law enforcement, in which all citizens should be asked to cooperate, to punish those who by carelessness or intent start fires or permit their spread.

There should be incorporated in the forest laws of every State requirements to bring all forest owners into the protective system, and to extend it to all cut-over and unimproved lands in the State. To these requirements should be added the disposal, by lopping or burning, of dangerous slashings, and other special measures that the local conditions may require.

There should be provided by the State the administrative machinery necessary to carry out the work effectively.

The public should share in the burden of protection. The division of cost will necessarily be different in different States, as is now the case among those States which have inaugurated such a system. The public may properly bear the cost of the State-wide patrol system, including overhead, inspection, lookouts, and similar items, and a portion of the fire suppression costs.

In general, the cost of the preventive system should be shared about equally between the public and the owner of the land. At the present time assistance by the States and the efforts of the private owners alike are inadequate. Measures like brush disposal are essentially a part of the logging operation and should be a charge against it.

The Federal government should grant liberal financial aid in fire protection, far greater than at present. This aid should be contingent on the State's inaugurating and carrying out such a system as above described, and this should not exceed in amount the funds appropriated by the State.

Protection Against Insects and Disease

As in fire protection, the spread of dangerous insect infestations and diseases requires the aid and direction of the public. Both the National and State governments should participate and appropriate liberally to check the depredations.

Forest Renewal

The renewal of forests on lands not needed for agriculture and settlement is an essential feature of a national policy of forestry and an effective program should be worked out in each State, backed by appropriate legislation and efficient administration, which will achieve this object on private as well as on public property. As in the case of fire protection, forest renewal on private lands requires the participation and aid of the public.

There are two problems of forest renewal; first, the restocking of lands already cut over and now in a condition of waste; and second, that of providing for natural reproduction when the timber is cut.

Where there are still seed or seed-bearing trees on cut-over lands, continued fire protection may in many cases suffice for restocking. Where there is no chance for natural reproduction, planting or sowing will be necessary. The public will have to take over a large portion of these cut-over lands and restore them to productivity. In many other cases owners may be induced to restock their waste lands as a business undertaking.

On lands still timbered provision for forest renewai should be made at time of cutting. Sufficient restocking of the average private tract may be accomplished by natural reproduction without resort to planting or other intensive measures. On certain types forest renewal will result from fire protection alone. In many instances of unrestricted exploitation, however, fire protection alone does not suffice to secure renewal and to prevent the lands becoming waste. If protection alone does not suffice to secure forest reproduction, the owners should be required to adopt such measures as may be necessary to accomplish this, with cooperative aid by the public in working out the problem as a practical undertaking. As in the case of fire protection, the additional measures necessary for forest renewal should be made a part of a systematic program in which the public and private owners engage in a joint undertaking with a common objective.

The first steps in this undertaking are to determine in each region:

1. The circumstances under which fire protection alone will not suffice to prevent wasting of the land under prevailing methods of lumbering.

2. The additional measures necessary to secure conditions favorable for natural renewal.

3. The classes of land upon which forest growth should be continued.

4. The cooperation that should be given by the public to make feasible in practice the measures that may be necessary for the owners to take.

5. The legislation needed to bring these measures into practice, as a part of the State's program of forestry.

As in the case of fire protection, the plan for special measures and for forest renewal should be worked out through State legislation and administration, with the assistance and backing of the Government. The Federal government should seek to secure concurrent action by the States within given economic regional units, to bring about uniform standards of practice, to conduct experiments and research, to grant material aid in various ways, and to act as a coordinating agent to bring together the different local agencies into full cooperation. The Government should make its assistance to the States contingent upon effective action by the latter.

Measures of forestry upon private lands sought by the proposed program fall into two classes: first, those necessary to prevent the lands becoming waste after lumbering; and second, those which seek a maximum production of timber and other products. The first class of measures should be required on all lands that ought to remain in forest growth. The measures to secure maximum production are of a more intensive character. They should be encouraged in every way but should not be obligatory. They involve a larger initial investment, and when they are practiced the lands render a larger ultimate return to the owner. Under the second class fall such measures as planting where needed, leaving a larger number of seed trees, cutting in favorable seed years, leaving medium sized trees even though now salable for a second cut or for cover, various kinds of thinnings of second growth, organization of the forest work on a basis of sustained annual yield, and so on. Experiments should be conducted by the public to establish and make generally known the best practice in each region. Advice by public officers should be freely afforded. Planting stock should be offered at cost. Taxes should be adjusted to encourage owners to undertake the methods found to be most efficient, and other measures of aid given as indicated in the last section of this statement.

Economical Utilization

Every encouragement should be afforded to bring about close utilization of timber in the forest and to prevent losses in the handling and use of the manufactured product. This will be accomplished largely

through cooperation and research, in bringing information to the knowledge of operators and users of wood products. It is a problem of investigation and industrial education, in which the public should take the leadership.

ASSISTANCE AND COOPERATION BY THE PUBLIC

In a national policy of forestry the public itself should assume certain responsibilities and certain burdens. It should cooperate with and assist private owners in carrying out their part of the undertaking. The measures of cooperation fall under the following heads:

1. *Fire Protection.*—As already indicated, the public should directly share the burden of fire protection, especially in a preventive system and in the cost of suppression.

2. *Assistance in Forestry.*—The public should assist owners in working out plans for cutting that will promote natural reproduction, in planting, and in other measures of forestry. The State should offer planting stock at cost and cooperate with the owners in establishing plantations.

3. *Taxation.*—The States should adopt a form of taxation calculated to encourage good forest practice. The present methods of taxation, with their lack of uniformity in application, often tend to promote premature and wasteful cutting and to discourage forest renewal. To promote action by the States, the Federal government should help the States to investigate the current methods of taxation, and their effect in causing premature and wasteful cutting and in increasing the difficulties of holding cut-over lands for tree growth, and should assist in drafting model tax laws applicable to various forest conditions.

4. *Forest Loans.*—Existing legislation concerning farm loans should be extended to include loans for the purchase and improvement of forest lands, to encourage the holding of lands previously acquired, where the purpose of the owner is to hold and protect cut-over lands or those having growing timber, to reforest lands by seeding or planting, or to use other measures in promoting forest production. To obtain the benefit of such loans, which should be for a maximum period of 50 years, the land owner should enter into a specific obligation to retain the land in growing timber and protect and care for it during the life of the loan.

5. *A Survey of Forest Resources.*—Funds should be provided whereby the Federal government in cooperation with State and private

interests may make a survey of the forest resources of the country. This would determine the quantities of timber suitable for different industrial uses, the current consumption of forest products, the probable requirements of the different regions for material, the possible production of the forests by growth to meet these requirements, and other matters which will aid in developing and carrying out the national forest policy.

6. *Land Classification.*—The public should cooperate in land classification to aid owners to put their lands to the most productive use. The public should aid in bringing settlers upon lands suited to agriculture, and at the same time should discourage speculative undertakings that lead to the deception of innocent investors and efforts to colonize lands which are not suited to settlement. Land classification would indicate the classes of lands which should be devoted to the production of timber, either permanently or pending a development which would make possible their successful settlement.

7. *Research Work.*—Adequate funds should be provided to enable the Government and other public agencies to carry on investigative work needed in carrying out a national policy of forestry. This would include investigations on a larger scale than at present for determining the best methods of forest practice, and also research in forest products.

8. *Forest Insurance.*—As soon as forest property becomes secure under systematic protection, fire insurance comes within the range of feasibility. Every encouragement should be given to plans of insurance such as that already inaugurated in the Northeast.

A program for the nation must be an aggregate of local programs adapted to different conditions, and correlated and standardized through the Federal government to meet the broader requirements of the whole country. A national program cannot be put into effect in its entirety at once. Local programs will also probably have to be worked out by steps. Some States are already able to go forward more rapidly than others, partly because of their financial strength and partly because experience has already demonstrated the methods of protection and forestry required to secure results on the ground.

The initiation of a national policy of forestry requires as one of the first steps the passage of a Federal law that recognizes its objectives and provides the Government with authority and means to extend cooperation with the States in protecting and perpetuating the forests

under their jurisdiction along the lines of the foregoing statement. At the same time, Federal appropriations for the purchase of forest lands should be greatly increased.

Much can be accomplished pending such a law. Thus, there should be at once a joining of hands in a most vigorous campaign for fire protection that will educate the public to the dangers from fire and lead to more effective action in all forest regions. Individual States should go forward with plans for better legislation and larger support of forestry. But the passage of a basic Federal law with the aid that the Nation can offer would make possible the inauguration of a policy that would secure results impossible without such national action.

FOREST DEVASTATION: A NATIONAL DANGER AND A PLAN TO MEET IT

REPORT OF THE COMMITTEE FOR THE APPLICATION OF FORESTRY, SOCIETY OF AMERICAN FORESTERS

Submitted for Consideration by the Society

LETTER OF TRANSMITTAL.

PHILADELPHIA, PA., *November 1, 1919.*

MR. FREDERICK E. OLMSTED, *President,*
Society of American Foresters,
Stanford University, California.

DEAR SIR:

The committee appointed by you to recommend action for the prevention of forest devastation on privately-owned timberlands in the United States has completed the attached report. The report is signed by all the members of the committee, but Prof. Donald Bruce and Prof. J. W. Toumey do so with the reservations set forth in their statements, which are appended.

In preparing this report, and particularly in the statement of our present forest situation, the committee has freely used the results of investigations carried on by various Government agencies, such as the National Conservation Commission, the Bureau of Corporations, the Bureau of the Census, and, above all, the Forest Service. To the last the committee is indebted for many of the facts upon which its conclusions are based.

Certain publications of the Forest Service, especially the recent addresses of the Chief Forester, Col. H. S. Graves, give so thorough an analysis of the effect of uncontrolled lumbering upon wood-using industries and local communities, and present the argument so convincingly, that no unbiased person can fail to appreciate the social and economic menace of our present policy. As Colonel Graves well says: "A national policy of forestry seeks the protection and beneficial utilization of our present forest resources, the renewal after cutting of forests on lands not needed for agriculture and settlement, the stability of forest industries and of satisfactory conditions for forest workers, and the restoration of forest growth on lands now idle and non-productive."

The program advocated by Col. Graves and that recommended by the Committee differ in certain respects. Col. Graves himself, however, is authority for the statement that while we differ in details we are working together, and our purposes are the same. The goal which he has set out to achieve is also our goal, and must be the goal of every forester and timber owner who has the perpetuation of our timberlands truly at heart.

The economic forces which are now at work make the success of our joint purpose imperative. This fact several of the more far-seeing organizations of lumbermen, such as the American Paper and Pulp Association, the Western Forestry and Conservation Association, and others, have begun to realize. Already they have committed themselves to policies in handling private timberlands which a few years ago would have been looked upon as extremely advanced. With these progressive policies, in so far as they recognize the need of preventing further devastation of our timberlands, the committee is of course in general sympathy.

Your committee has felt constrained, instead of endorsing remedies already proposed, to suggest a plan of its own, because of its deep conviction that the forest problem in this country cannot be solved merely by an effort to keep the land growing trees, but must rest also upon changes in the economic conditions of the lumber industry itself. Economic conditions in the industry cannot but have their reflex upon the practice of forestry in the woods. Accordingly the committee has attempted to outline a national forest program which would take into account both the silvicultural and the economic aspects of a problem whose vital importance to the Nation it would not be easy to overstate.

In submitting a plan of suggested legislation the committee has merely indicated the general outline which, in its judgment, such legislation should follow. It realizes fully that beneficial changes in detail should be and undoubtedly will be developed as the discussion proceeds.

In presenting its views your committee was not prompted by any ill-feeling toward the great industry in the perpetuation of which the Society of American Foresters is most concerned. Some members of the committee have, indeed, given years of their professional life to the study of lumber industry problems and the sympathetic understanding of the difficulties under which the lumbermen have been working. We have no personal material interests to defend. Our sole purpose has been to get to the root of the problem, to see the situation as it is, and to suggest remedial measures which would protect the interests and meet the needs of the Nation as a whole.

The results of its work the committee now submits for consideration and action. It suggests that this report be published in the JOURNAL OF FORESTRY, and that you take steps to give it such other publicity as its importance may deserve.

Sincerely yours,

GIFFORD PINCHOT,
Chairman.

I

THE FACTS

SUMMARY

A good and continuous supply of forest products is necessary for the safety and the prosperity of the United States in peace or in war.

The beginning of timber shortage is here already, and cannot but grow worse for many decades to come. In item after item the price of lumber and other forest products is already almost prohibitive.

We are consuming nearly three times more wood than we are producing. As with any other crop, wood cannot be consumed faster than it is produced without exhausting the supply. At the present rate, our saw-log timber will be gone in about fifty years.

It is possible, but probably not practicable, to reduce the rate at which our timber supplies are used up. Our per capita consumption of lumber is decreasing, but population is increasing more than fast enough to make up for it, so that our total consumption of wood will tend to increase.

But if we can use less, there is still a limit below which we cannot safely go. Western Europe has long been at or below this limit. Although one-fourth of its entire land area is in permanently productive forests, and although it uses per person less than half as much as we, Europe has been forced to import increasing amounts of timber. There is every probability that our use of timber must shortly be reduced to the European level.

We cannot make good our timber deficit by importation from abroad, because the shortage in high-grade timber is world-wide.

We have exported timber freely, but now our forests cannot much longer supply us at home. We must either go without essential timber supplies, to the great hazard of our national safety and the certain sacrifice of our industrial prosperity, or we must take immediate steps to assure ourselves an adequate supply of home-grown timber, which it is perfectly practicable to do.

The present timber deficit has long been foreseen and efforts to meet it have not been lacking. National and State Forests have been created. But the timber of the National Forests is largely inaccessible, and cannot for many years be a material factor in the market. The greatest annual cut of timber which the National Forests may eventually be able to supply cannot exceed one-fourth of what we are using

now. State Forests are insignificant in area, and their yield of timber is practically nothing.

We cannot keep on forever cutting timber faster than we grow it. We know already our present cut, our present stand of timber, and how fast timber may be made to grow. How much growing forest is necessary to produce, year after year, any required amount of timber can readily be found. We find, in fact, that twice as much standing timber as we now have is necessary to maintain our present yearly rate of consumption.

Nothing yet done or heretofore proposed will keep our timber supply at a safe level. And whatever is done needs to be begun at once.

A shortage in most staple crops can be made good in one year, but timber is a long-time crop. To mature a timber crop requires from 50 to 100 years, or more, and no urgency of need nor amount of money and effort can shorten the period. Within less than fifty years, our present timber shortage will have become a blighting timber famine.

The present situation has developed out of the existing practice of lumbering, which is based on the careless assumption that "we have timber enough to last us." Under past and present lumbering practice, mature crops of native timber have been harvested wholly without regard to succeeding crops. No provision has been made for the starting of new forest growth, for protecting it from the fires which follow lumbering, or for the care of young timber. No effort has been made to keep forest lands growing timber. As a result, lands which have been at work, century after century, producing forests which have maintained and renewed themselves without care or cost, are transformed by the lumbering into non-productive wastes of blackened stumps and bleaching snags. This is forest devastation.

Within the United States, forests having more than three times the area of Pennsylvania, or five times that of Iowa, have already been devastated; and the total thus made waste is fast increasing.

The utilization of ripe timber is proper and necessary; forest devastation is an unmitigated evil which threatens the safety and prosperity of the Nation. Forest devastation is wholly unnecessary, for it is entirely practicable to harvest the mature timber of a forest without forcing the land into indefinite years of utter idleness. Lumbering must continue; forest devastation must stop.

Privately owned forests contain four-fifths of the timber now standing in the United States. They yield 97 per cent of our annual timber cut. By reason of their size, quality, and location, they must

always furnish the bulk of the Nation's timber supply. It is these privately owned forests which are being devastated. It is their devastation which must be stopped.

Although they insist that they are essential to the safety and prosperity of the Nation, the forest industries have taken no steps to insure their own perpetuation, have made no effort to put an end to forest devastation, and have persistently avoided all responsibility for maintaining a dependable supply of forest products.

In its own behalf, and for its own protection, the public must intervene. Further delay will merely aggravate the situation.

The action required is obvious: forest devastation must be stopped: lands now in forest must be kept continuously productive; forest lands now devastated and idle must be put to work.

Specific means to these ends are here proposed.

THE FOREST SITUATION

AN ADEQUATE SUPPLY OF FOREST PRODUCTS IS ESSENTIAL TO THE SAFETY AND PROSPERITY OF THE NATION

A large and accessible supply of forest products is as essential to the national defense as coal, steel, or transportation. The workings of coal and metal mines are supported by wooden props; the best steel is made from metal smelted with charcoal; railroads run upon wooden ties. There is not one item in the list of indispensable munitions of war which does not involve the use of forest products.

The same is true of the requirements of peace. Every peace-time industry is dependent in some degree upon a supply of forests products. Food, clothing, and shelter of every kind require wood for their production. No wood, no agriculture, no manufacture, no commerce. Without the products of the forest, civilization as we know it would stop. In peace as in war the safety and prosperity of our country hangs upon a steady and generous supply of materials which the forest alone can produce.

A TIMBER SHORTAGE ALREADY EXISTS IN THE UNITED STATES AND IS RAPIDLY BECOMING ACUTE

We are in the early stage of a timber shortage, which for many years must continue to grow worse.

The forests of the Northeast have been so reduced as to supply but a fraction of the region's needs. Pulp-wood, for example, has become so scarce that many of our mills depend upon Canadian forests, which

are being exhausted in their turn. The Northeast today imports the bulk of its lumber supplies from distant parts of the country at enormous cost for freight, in spite of the fact that it has vast quantities of idle land suitable only for lumber production.

The Lake States, 30 years ago the greatest lumber producers in the history of the world, today are able to supply themselves with but a small part of the timber they use. Their pine forests are almost exhausted. Their commercial hardwoods will be gone within 25 years. They import enormous quantities of timber from the South and the far West, yet in the three Lake States there is as much idle land as the whole area of Michigan.

The southern pine region, for the last 20 years the world's greatest producer of high-quality timber, is rapidly declining. Within 10 years 3,000 pine sawmills will be junked, and the region's annual cut of pine will fall off by 50 per cent. The southern pine region has 75 million acres of cut-over land.

The Pacific Coast region has today the world's greatest stand of high-grade timber. Within 10 years it will be supplying the bulk of the Nation's lumber. It has great areas suitable only for forests.

As the more accessible forests are devastated, the length and cost of the freight haul between the remaining forests and the centers of consumption constantly increase, and the logging of more and more inaccessible timber becomes steadily more expensive.

The effects of timber shortage is shown not only by the soaring prices, but also by the constant lowering of the quality of lumber on the market. Grades and kinds which, even 20 years ago, were considered hardly worth manufacturing, today furnish large parts of the stocks in trade. As the better trees approach or reach exhaustion, poorer kinds and lower grades must take their places.

High prices and the growing scarcity of high-grade timber are responsible for the tremendous substitution of other materials for wood. This substitution already amounts to a fourth of our total annual consumption of wood, and it increases steadily. In most cases it means higher cost to the consumer; in many cases, less satisfactory products.

The constant increase in cost, the constant lowering of quality, the steady substitution of other materials for wood, all certify not only that a tremendous deficit in timber supplies is on the way, but that an important shortage is here already.

TIMBER SUPPLIES ARE DECREASING—PRICES WILL CONTINUE TO INCREASE

In spite of the continuous exhaustion of local forests and the increasing distance of our remaining timber supplies, the consumer is still able to secure supplies of the more essential forest products. He can do so, however, only at a rising cost, with a falling quality, and with the substitution of other materials for wood. The rising cost is due to freight charges for longer hauls, to the operations of middlemen, and to interest charges upon the capital now necessarily invested in the vast business of manufacturing and moving lumber and other forest products from ever receding sources to ever more distant markets. Supplies are decreasing with dangerous rapidity. Prices now are high, and there is every indication that they may still go higher.

Current supplies and prices are temporary only. At our present rate of consumption, the present stand of mature timber, amounting to 2,500 billion feet, would be exhausted within 50 years, which is no long time in the life of a nation. A greatly increased export trade, which now seems probable, would materially reduce this period. Utter exhaustion of this stand is not to be expected. But a degree of shortage amounting to famine will come long before the forest is entirely gone.

A bread famine begins while there are still large amounts of grain in storage. In its early stages, it is largely due to unequal distribution of the supplies still available. As the shortage becomes known, prices tend to soar and profiteering follows. As the shortage spreads, much of the population may be suffering long before actual starvation begins and long before all the grain is gone. Utter exhaustion of the grain supplies of a nation is practically impossible, but nation-wide famines are well known.

A shortage in timber may be expected to follow the lines of other famines. But there is this essential difference between a shortage in timber and a shortage in grain—grain can be sown, grown, and harvested in a summer, so that a shortage in wheat can be made good within twelve months. Forests also must be sown, grown, and harvested before they can be used, but the time required to grow a timber crop is not less than 50 years and normally exceeds a century.

Since our present stand of mature forest is good for but 50 years or less, and since new forests cannot by any chance reach log size in less than that time, it is certain that only the most immediate and effective action can in any measure bridge the gap between the exhaustion of the old forest and the growth of new supplies.

Efforts to bridge this gap might be made in three ways: (1) by reducing our consumption of timber, (2) by importing timber from abroad, (3) by growing new forests at home.

NO PRACTICABLE DECREASE IN WOOD CONSUMPTION CAN PREVENT A TIMBER SHORTAGE

Our abundant use of high-grade timber has been one of the greatest factors in our prosperity, and has given us important advantages over the nations with which we must compete. At the same time we have been careless and wasteful in our use of wood, and our per capita consumption is very high. There will be, therefore, no great suffering, if we get along with somewhat less.

Our per capita consumption, in fact, is growing less, as would naturally follow when supplies are fast decreasing, population is fast increasing, and costs rising toward prohibitive levels. But there is a limit beyond which we cannot safely reduce our use of wood.

Industrial Europe has a per capita consumption of 150 board feet, has found itself short of high-grade timber, and has been forced to supplement domestic supplies with constantly increasing imports. We have been using some 350 board feet per capita. But within 50 years our lumber cut must drop far below 30 billion feet—less than 150 feet per capita in a population of 200,000,000 (as ours will be then), or less than the amount which Europe has already found to be inadequate. To its timber supply Europe has become adjusted during the course of many centuries; we cannot expect to adjust ourselves to a reduction to the European level without suffering tremendous punishment through the dislocation of our industries and the disturbance of our habits of life.

Even though we substitute other materials for wood in every practicable case, even though we bend every effort to reduce our consumption, we shall, nevertheless and very shortly, need more wood than we can get.

Our population increases faster than the shrinking in per capita consumption, so that the total of our timber consumption tends to increase. It will continue to grow with our population, save as inferior quality and intolerable prices prohibit the generous use of forest products. And that means widespread suffering among our people.

DEPENDENCE UPON IMPORTED TIMBER SUPPLIES IS FUTILE

The bulk of the world is today so inadequately supplied with timber as to be industrially handicapped. Except the United States, the industrial nations are all importing timber. Europe, with a fourth of its

entire land area in continuously productive forests, yet imports increasing quantities of forest products.

For many years America has furnished an important part of the world's timber trade. When the American forests become exhausted to a point where we must import any considerable part of our timber supplies, we shall be forced to compete with all the rest of the world for whatever remains of the world's virgin forests.

Of the important timber regions of the world, only Siberia, South America, the Congo, and the East Indies remain unexploited. The Amazon and Congo forests are tropical hardwood jungles, yielding little wood of a quality suitable for our uses. Africa and the East Indies are for the most part colonies of European countries, and will be able to furnish very little lumber to our markets. There is no evidence that the supply of Siberian softwoods is great, and the domestic requirements yet to be developed in Siberia are unknown.

We still have the greatest stand of high-grade timber available to any modern nation. We have millions upon millions of acres of forest which can easily be made to produce continuous timber supplies. We have millions upon millions of acres of forest land lying idle and non-productive which can be put to work again producing what, in peace or in war, is a national necessity. It is preposterous that the United States should become dependent upon a foreign supply of timber. A foreign supply, in addition to its high cost, must always be subject to the hazards of ocean traffic. In view of our experience in the Great War, the mere suggestion is well nigh disloyal.

OUR STOCKS OF GROWING TIMBER ARE SHORT BY FIFTY PER CENT

It is evident that we cannot continue indefinitely to cut our forests faster than they grow, and that we cannot continue to consume more timber than is currently produced.

The annual growth of wood upon a tree or in a forest is added to the growth of previous years just as interest is added to principal. Well-managed forests add wood at an average rate of 2 per cent, and there is no way to increase it. This statement does not refer to money return, but only to the growth of wood. Considering only sawlog material and assuming that it forms half of the total wood produced—in other words, that the annual increase by growth in sawlog timber is at the average rate of 1 per cent—it is clear that our present total consumption of 50 billion feet of sawlog timber will require a stand of growing timber equivalent to 5,000 billion feet. Our present

stand of merchantable timber is but 2,500 billion feet, which, moreover, includes a disproportionately large amount of over-mature timber not growing at all. It is evident that, instead of a surplus, good for 50 years, we have today a tremendous deficit in growing timber, and that this deficit amounts to more than half the forest necessary to grow what we are using now, to say nothing of the larger needs of the future.

THE PRESENT NATIONAL AND STATE FORESTS CANNOT MAKE GOOD THE DEFICIT

The present timber situation has long been foreseen, and the National Forests were created in part to meet it. They are indispensable, and they will be kept continuously productive. Their value, not only for lumber, but also for protecting the water supply of irrigation farmers, for public recreation grounds, and for numerous other uses, is already so extensive as to make them one of the great assets of the Nation. But most of these forests are located in the roughest and most inaccessible parts of the western mountains, the average quality of their timber is below that of much of the timber we are cutting now, and the cost of logging is so great that only a small part of the National Forest timber is as yet available.

The National Forests are enormously valuable, and will furnish a rapidly increasing part of our timber supply. But it was known from the first that they can never yield more than a part of what we require. Ultimately they should be able to grow four times as much new timber each year as they are now growing, but even that will represent but one-fourth of the timber we are consuming already.

A few State Forests have been created, but they include less than one per cent of our forest lands. Most of them were assembled out of lands which had been logged and burned repeatedly. Their present stand of timber is practically unimportant and for many years their yield of merchantable timber will at best be nominal. Many of the forest States have no State Forests whatever.

State Forests may eventually become important in the national timber situation, but not for many years. The present State Forests can play but little part in meeting the timber shortage which confronts us.

Occasional privately owned forest estates have been handled with a view to permanent production, but such lands form only a negligible fraction of one per cent in the total of our forests.

Farm woodlots carry a very large part of all our hardwood timber. With rare exceptions, the woodlots are growing but a tithe of the

timber they might be made to produce. The quantity and quality of woodlot-timber is constantly deteriorating.

The national timber supply cannot be made secure through the existing National Forests, State Forests, farm woodlots, or private forest estates. All these taken together at best can furnish no more than a small part of the timber required. Nothing but the wise handling of our commercial timberlands, by saving or restoring their productive power, will maintain our timber supply at a safe level.

THE TIMBER SITUATION IS DUE TO FOREST DEVASTATION, NOT TO LUMBERING

The early settlement of the United States took place mostly in the eastern valleys, where heavy hardwood forests were almost unbroken and where the land could not be farmed till the forests had been removed. Since, therefore, the land could be cleared only by destroying the forest, deliberate forest destruction by axe and fire became accepted as normal and necessary.

As the demand for lumber grew and lumbering became an industry, the enormous extent of our forests easily led to the belief that our forest resources were inexhaustible. The fact that clearing was so widely necessary, and the notion that there was "timber enough to last the world forever" led to a general disregard for the perpetuation of our forests.

The lumbering practices thus begun still prevail. Forests are bought and sold for the merchantable timber they contain, with little or no regard for the value of the land which produced them. The lumberman charges his original investment, in both land and timber, against the timber he removes in logging. What may become of the land after logging is of little or no interest, save as the cut-over lands may offer chances for profitable speculation. As it exists in the United States, lumbering is timber mining.

With rare exceptions, American lumbermen leave the brush and slashings caused by logging in whatever condition best suits their convenience. Shortly the slashings become dry and inflammable, and fire regularly follows. Season after season fire succeeds fire across the old cuttings. Within a few years, lands once covered with valuable forests, which maintained and renewed themselves for century after century, are changed into stretches of ragged scrub, blackened stumps, and bleaching snags, with here and there unsound or undesirable green trees, or a group of saplings which happened to have escaped both axe and fire. This is the normal course of forest devastation.

Forest devastation has been so long continued and is so widespread that in the eastern half of the United States alone 100 million acres have been changed from rich forests into idle wastes. This is an area three times that of Pennsylvania or five times greater than Iowa. That fire must follow lumbering is accepted by lumbermen as a matter of course. That is one reason why forest devastation continues unabated and the area of idle forest land is constantly and enormously increased.

Forest devastation has created the present shortage in forest products. It is responsible for our tremendous deficit in growing timber, it has thrown great regions into virtual bankruptcy, and it has generated labor troubles of dangerous proportions.

To cut and use mature timber is necessary and right; to devastate the forest is wrong and needless, and it must be stopped. It is wholly practicable to harvest the ripe timber of a forest without forcing the land into long years of useless idleness.

If destroying the forest to make way for farms may once have been necessary, if ruining the forest by lumbering may once have seemed expedient, it is now neither necessary nor expedient. Forest devastation has long been an unmitigated evil; today it threatens our national safety and undermines our industrial welfare. Lumbering must continue; forest devastation must stop.

WHOLLY ADEQUATE EVIDENCE AS TO THE SITUATION IS NOW AVAILABLE

We know enough about forest conditions in the United States to act without delay. Evidence has been piling up for 30 years and more. Within the last 10 years repeated and elaborate Government investigations have covered almost every phase of the forest industries. These investigations have been conducted by many different official bodies and for varying purposes, but whatever the agency and whatever the purpose, the final reports confirm each other as to the basic facts.

The basic facts are these:

1. The United States is the world's greatest timber consumer.
2. The bulk of all our standing timber is privately owned.
3. The privately owned forests have been and are being devastated.
4. The acreage of idle forest lands is already enormous and is rapidly increasing.
5. A timber shortage has already developed.
6. The timber shortage will soon become more acute.
7. The timber shortage is due to forest devastation.

8. Nothing yet done or heretofore proposed offers an adequate remedy.

9. The only possible remedy is to keep enough forest land growing trees.

10. To maintain our forests in continuous production is easily practicable.

Further inquiry into many details of the forest situation is highly desirable and even urgent, but no amount of investigation will change the basic facts already established. We know enough to go ahead. Plans and pleas which assert or assume that the essential facts are not yet known, or which urge or suggest that further, or different, or continued, or supplemental, investigations must be undertaken before we can begin, will serve merely to bolster up deliberate attempts to block or postpone the taking of measures which are vital to the public safety and welfare. That such attempts to block and postpone action are being made and will be made there is no doubt.

TO MAINTAIN FORESTS IN CONTINUOUS PRODUCTION IS NOW PRACTICABLE

We know enough about our forests, also, to keep them growing. To get young trees growing in the ground, and to protect them from fire and other enemies, are operations well within our present powers. They are not so involved, difficult, or highly technical as to require further detailed investigations, studies, and researches before starting to practice what we know already.

It is true that much remains to be learned about our numerous tree species. It is true that a systematic and comprehensive program of forest research is urgently needed. But it is equally true that we have now knowledge enough to grow and protect valuable tree species upon any land where forests may reasonably be desired. We know it can be done because it is being done. Further studies will doubtless give us better practice and cheaper methods, but well tested practice and effective methods are now available. We are all ready to go ahead.

There is no sound or scientific reason for delay in taking the simple and obvious steps necessary to insure the Nation an adequate and dependable supply of forest products.

EXTENT, LOCATION, AND CONDITION OF PRESENT FOREST AREAS

The present total forest area of the United States, in round numbers, is 500 million acres, including cut-over, devastated, and idle forest lands as well as those upon which merchantable timber is now stand-

ing. Of this area, some 16 per cent is located in the mountainous portions of the Eastern and Northeastern States; 27 per cent is in the Southern States bordering the Atlantic and Gulf; 23 per cent is in the Central States, including the northern portions of Michigan, Wisconsin, and Minnesota, the mountain regions of Kentucky, Tennessee, and Arkansas, and the farm woodlots of the Ohio Valley; 19 per cent is in the Rocky Mountain region; and 15 per cent is in the Pacific States, principally in the Cascade and Sierra Mountain ranges.

Of this total forest area of 500 million acres:

One hundred million acres and more are so devastated as to be almost wholly nonproductive.

Over two hundred and fifty million acres have been cut over and more or less damaged by fire, but are producing new timber, usually in small amounts.

One hundred and fifty million acres are in standing timber where growth merely balances decay, with no net increase in wood production from year to year. On a large part of this area the virgin timber is of poor quality and very inaccessible.

Of the 500 million acres of forest land, 400 million, in round numbers, are in private ownership, and 100 million are publicly owned. Most of the publicly-owned timber is in the National Forests, whose total area is about 155 million acres in all. This figure includes lands above timber line, parks temporarily deforested, old burns, etc., so that the area actually under forest at this time is much smaller. Because it is of poor average quality and hard to reach, it will be many years before the National Forest timber can play any considerable part in the general timber market.

Eighty per cent of our standing merchantable timber is privately owned.

Ninety-seven per cent of our annual cut comes from privately-owned forests.

By reason of their extent, quality, and location, the forest lands now in private ownership have always furnished and must always furnish the great bulk of the Nation's timber supply.

It is the privately-owned forests, our chief dependence for the present and the future, which are being devastated.

A few men have secured vast amounts of private timber and timberlands. Already 1,802 owners control more than 79,000,000 acres of the forest lands of the United States. In Florida, 182 holders own more than 9,000,000 acres. In Michigan over 5,000,000 acres are held

by 32 owners. In Louisiana, 27 holders own more than 6,000,000 acres. In the Pacific Northwest, 3 owners have more than 9,000,000 acres. And these are but typical instances.

POLICY OF THE OWNERS OF THE PRIVATELY HELD TIMBER AND TIMBERLAND

The United States Commissioner of Corporations, having conducted a very detailed investigation as to the timber situation, in his report to Congress on The Lumber Industry, says (Part I, p. XXII):

"The largest holders are cutting little of their timber. They thus reserve to themselves those incalculable profits which are still to accrue with the growth of the country, the diminishing timber supply and the further concentration and control thereof. * * * The fact that mature timber is thus withheld from use is clear evidence that great additional profits are expected to accrue through further increase in value. * * * Standing timber is not the only question. When the timber is cut the land remains. There has been created, therefore, not only the framework of an enormous timber monopoly but also an equally sinister land concentration. This involves also a great wealth in minerals. * * * Finally, to timber concentration and to land concentration is added, in our most important timber section, a closely connected railroad domination. The formidable possibilities of this combination are of the gravest public importance. * * * The concentration already existing is sufficiently impressive. Still more impressive are the possibilities for the future."

OUR ANNUAL CONSUMPTION OF TIMBER IS 100 BILLION FEET

The wood we are now using each year amounts to 100 billion feet board measure. Of this, about 50 billion feet is lumber and other products cut from trees big enough to saw. Most of the balance comes from timber of less than saw-log size or quality. This rate of consumption can not be maintained.

OUR PRESENT ANNUAL GROWTH OF TIMBER IS 35 BILLION FEET

Our total yearly growth of timber amounts to about 35 billion feet, or less than half our annual consumption. The annual cut is nearly three times the annual growth. Much of the new growth, moreover, being young, accidental, and untended, is of poor quality. Artificial forest plantations are negligible in amount. The annual growth of material which will make sawed lumber is only about 9 billion feet, and some 2 billion feet is destroyed each year by fires and other causes, so that our net annual increment in lumber is only one-fifth of the amount we cut.

THE MAXIMUM POSSIBLE GROWTH UPON THE AREA NOW AVAILABLE CAN BARELY SUFFICE

If the 500 million acres of our present forest area were reasonably productive, the annual growth of timber in the United States would be 150 billion feet. But the 500 million acres are not reasonably productive, for 100 million acres lie devastated and idle, while 150 million acres are in timber which is merely holding its own against decay. Only 250 million acres are producing additional forest growth. These forest lands have escaped complete devastation only by accident. They have been cut over and more or less burned, but are still covered with growing forest, of a kind. It is upon these 250 million acres or more that our annual growth of 35 billion feet of timber is taking place. Since these forest areas escaped devastation only by chance, and since their growth is scattered, untended, and small, the timber which they will yield must be of very poor quality compared with that to which we are accustomed.

Our present timber supplies are coming mainly from virgin timber which will average not less than 200 years in age. At the present rate the old forests will be exhausted within 50 years. We must then fall back upon whatever "second growth" may have reached merchantable size. And there will be less than half enough of it to meet our needs.

To grow a tree of fair log size will require an average of from 60 to 100 years. No matter what we may do, it is evident that a period of acute timber shortage is coming between the exhaustion of the old growth and the ripening of the new, and that it can end only when enormous areas of new forests grow old enough to cut.

New forests can be developed from three sources:

1. By reforesting the devastated lands upon which there is now no forest growth.

This must be done, and upon a very large scale. But the process will be slow and comparatively expensive, and since such forests will have to be started from the very beginning, the harvest of mature timber must be long deferred.

2. By protecting and helping the accidental growth upon the partially productive lands now cut-over but still retaining some manner of growing forests.

This is obviously practicable and necessary, but no amount of protection and help (as by the removal of profitless material, thinning of too crowded stands, or planting in vacant places) can provide enough

useable timber to supply the Nation, for the time is too short and the areas too small.

3. By stopping the devastation of the virgin forests which yet remain to be cut over.

To prevent forest devastation is to make sure that there will always be a forest on the land. If the mature timber is to be cut, and if a forest is still to remain upon the land, there are two alternatives: either to cut the original forest clean and restock the bare land with young trees, naturally or by hand; or to cut only the mature timber without destroying the young and middle-aged trees which make up fully 90 per cent of our virgin forests. These young and middle-aged trees, already well advanced toward useful sizes, will become merchantable many decades before mere seedlings can grow to be of any service.

If the gap between the exhaustion of our old-timber forests and the maturing of our new-timber forests is to be bridged, it must be done by keeping alive enormous numbers of trees, now of young and middle age, so that they may reach maturity and supply the lumber we shall need in 50 to 100 years. There is no way of doing this save by preventing the destruction of trees of the requisite ages and sizes that are now alive. These trees exist in our virgin forests. To continue destroying them will precipitate a timber famine; to save them offers the only chance of preventing one.

To conduct logging operations without forest devastation will usually (but not always) add to the cost of lumbering. The increased expense will, in certain instances, be material, in others only nominal. Whatever the costs, they will be insignificant compared with the prices which the consumer of forest products must already pay, and they will be altogether trifling compared with the prices which will have to be paid if forest devastation continues. In 1909 the average price of newsprint paper was $2.25 per hundred pounds; in 1919 it is $4.50. In 1909 the average mill price of lumber was $19.50 per thousand feet; in 1919 it is in the neighborhood of $44.00.

Fully stocked and well managed forests produce timber at the rate of not over 300 feet board measure per acre per year. It is not likely that we could, under any circumstances, get the whole of our forest area up to such a rate of production in less than a century. Moreover, within a few decades the present total of our forest lands will be reduced by the passing of many millions of acres into agricultural and other uses. This reduction of acreage will be more or less offset by

the return to forest of lands now unprofitably used in farming or otherwise, but it is very improbable that we shall have, at the end of the next 50 years, as much as 400 million acres which are actually producing new and merchantable timber at the rate of 300 feet per acre per year. This area and rate, if we could attain them, would provide a total annual supply of but 120 billion feet, or an excess over present consumption of only 20 per cent. But in 50 years our population will probably double. It is obvious that only the most immediate, comprehensive, and effective action can, by any chance, insure to the Nation anything like a safe or adequate timber supply.

ACTION REQUIRED TO FORESTALL TIMBER FAMINE AND MAKE GOOD TIMBER DEFICIT

(*a*) The action of first and highest importance is to stop forest devastation, so as to keep our remaining forests growing trees.

This will require legislation. In order to assure the same treatment to all owners of forests in the various States and forest regions, and in order to prevent long continued delay, which would be fatal to the safety and prosperity of the Nation, the essential legislation must be Federal rather than State.

(*b*) Action which will maintain and increase the growth of forests now only partially productive comes next.

Not only must the devastation of the "second-growth" forests be prevented, but they must be so handled as to restore at least some part of their original productive power. Legislation to such ends must be, in the main, and for similar reasons, Federal rather than State, but State legislation will still be highly important, especially in dealing with fire and taxes.

(*c*) Finally, vast areas, once forested but now mere idle wastes, must be brought back into bearing.

This work should be undertaken promptly and upon a very large scale. To this end both Federal and State legislation will be required.

These are the three great forest tasks before us.

The essentials of the required legislation have been formulated.

FOREST DEVASTATION

FOREST DEVASTATION AND THE NATIONAL DEFENSE

The experience of the war proved in conclusive fashion the need for great quantities of forest products easily accessible. The devastation of our forests and the scant supplies of many of our most necessary kinds of lumber created situations which were difficult to the point of being desperate. Ship timbers were billed across the conti-

nent on passenger train schedules, because enough big timber of the kinds required could no longer be found in the East or South. Walnut for rifle stocks and airplane propellers was so badly needed that shade and park trees had to be sacrificed and barely filled the gap. Battalions of men went into the eastern mountain forests to get out the chestnut wood and the oak and hemlock bark used in the tanning of leather for shoes and harness. Regiments were employed in getting out spruce for airplane construction. The shortage of hickory handles for trench, railroad, and mine tools ran into millions. Only by extraordinary effort could enough rough lumber be assembled in time to build cantonments and house the workers at the shipyards and munitions plants.

War involves not only lumber and wood in innumerable items, but also all manner of forest by-products, such as acetone, chloroform, iodoform, rosin, charcoal, fustics, pitch, balsam, turpentine, flotation oils and methyl alcohol, tannic and acetic acids. Pulp and paper come from the forest. Wood furnishes the cheapest supply of cellulose and pyroligneous acid.

So great was the drain of the war industries upon our depleted forests that in many cases essential munitions materials are practically gone. Today it would be very difficult and far more costly to duplicate the supplies of walnut, ash, and spruce which the war consumed; within 15 years it will be impossible to assemble so quickly even the amount of rough lumber used in emergency war construction, since the bulk of it will have to be shipped from the West coast. This would not be true had our forests been used but not abused, had the great forest regions near to the center of population and industry not been devastated.

FOREST DEVASTATION AND THE CONSUMER OF FOREST PRODUCTS

If the cut-over lands of the East, the Lake States, and the southern pineries had been handled with foresight, the lands now idle in those regions would be growing, each year, as much timber as was cut in the year of their greatest lumber production, and that timber would be available to the consumer at a lower price than he is now paying. The difference is what the consumer pays for forest devastation.

A considerable part of the present cost of lumber is the freight. The devastation of the nearer forests and the consequent longer haul has brought our annual freight bill, on lumber alone, to 175 million dollars. Within 20 years the bulk of our lumber must come from the far West.

When it does our freight bill on the same quantity of lumber now shipped will amount to 650 million dollars a year, even if freight rates are not increased. And lumber represents but 35 per cent of our traffic in forest products.

As region after region is devastated, one valuable species of timber after another can no longer be obtained in large quantities at reasonable prices. White pine has given place to southern pine, southern pine to hemlock. White ash, cedar, yellow poplar, cherry, and hickory are today so scarce and so expensive as to limit their use for purposes in which all available substitutes are much less satisfactory. Well within 20 years still other highly important species, such as cypress, longleaf pine, and high-grade oak, will be equally unavailable. Moreover, the consumer suffers constantly by the persistent lowering of quality, for not only do prices steadily increase, but the higher prices do not buy such useful material as was recently available.

DEVASTATION AND THE FOREST COMMUNITY

With the opening of great forest areas come new camps, new railroads, sawmills, and industries dependent upon the forest for raw material. Towns develop about them, with new commerce and new life. With the opening of local markets for food supplies comes also the development of new farms. More people move in; the region booms; business is good.

Soon new roads and schools are needed and more tax money must be raised. Timber, being the only considerable local resource, must carry the cost of local improvements. Taxes on the timber now go up. Lumbering proceeds rapidly, and far faster than the clearing of the land for farms. But as the timber is cut the principal tax resource dwindles and taxes upon the remainder must increase, often to a point which forces still more rapid lumbering.

Within a few years the timber is gone; the resource which sustained all local industry is exhausted; the prosperity of the community has been exported without provision for the future; and the slash fires have taken what little the lumberman happened to leave.

With the exhaustion of the timber supplies, the sawmills and other wood-working plants must be junked or moved again to new forest areas, taking with them much of the local population. Business now falls off, stores are boarded up, and railroad lines are dismantled. The local market for farm produce shrinks or disappears, as people move away. Tax returns become too small to maintain local improvements;

schools and roads fall into disrepair; commerce and industry die. This is the regular order; this is the inevitable result of forest devastation. Hundreds of communities have gone this road and hundreds more must follow if forest devastation is not stopped. Such communities recover slowly if at all. Even where soil and climate allow profitable farming, the development of new taxable resources is inevitably slow, costly, and difficult. Where the conditions are unfavorable, such recovery is often impossible.

Long periods of tax deficit normally follow forest devastation. Tax delinquency, involving millions of acres of land, sets up new and burdensome charges which still further increase the cost of State and county administration. Because of it hundreds of townships, and even whole counties, are today in a state of virtual bankruptcy, reduced to the condition of paupers dependent upon outside assistance for the very existence of their schools, their roads, and their police protection.

INDUSTRIAL EFFECTS OF FOREST DEVASTATION ARE GENERAL AS WELL AS LOCAL

The exhaustion of local forests creates losses which are felt far beyond the neighborhoods actually devastated. As lumbering comes to an end, leaving in its wake enormous areas of idle land, a great shifting in population, commerce, and industry takes place. As the camps supported the forest communities, so the forest communities in large measure support the neighboring towns and cities. Decay of industry at these local points of consumption and supply soon shows as business restraint in the more distant centers of production and distribution, and in the transportation facilities of the whole region.

With the exhaustion of its own forest supplies, State after State has become an importer rather than an exporter of timber. This change would not be lamented if the cut-over areas of such States were profitably at work. But these lands, devastated and non-productive, grow nothing profitable, while the balance of the State, by its import of timber, lends temporary prosperity to distant forest regions. These are devastated in their turn, and thereupon lapse into economic decay. It would be as reasonable that Iowa should import corn or that California should depend upon Florida for oranges, as that Michigan, with one-third of its area in idle lands, should depend upon Mississippi and Arkansas for its pine and its oak. Pennsylvania has five million acres of devastated forest which is costing the people of the State, in loss of wages and taxes and forest growth, and in freight charges on imported timber, twice as much each year as the entire

cost of maintaining the State government. These are but typical cases.

When lumbering shifts from exhausted to new and unexploited regions, only a small part of the commerce and industry it developed can shift with it. Most of it fades out and dies. New industry and commerce develop with the opening of new regions, but the quickening of the new does not revive the old, nor does it make good the losses of the region just devastated. As region after region is lumbered and cut over, prosperity is not merely shifted, but much of it is permanently lost.

The total of commerce and industry dependent upon the forest must shrink in proportion as the forests are exhausted. Excluding land and timber values and including only manufacturing plants where the raw material is chiefly wood, $3,000,000,000 are now invested in the forest industries of the United States, together with the industries directly dependent upon the products of the forest for their raw material. The annual value of the products of these industries is $3,500,000,000. If our forests disappear, these enormous values will be lost.

The lumber industry has moved from the Northeast to Pennsylvania, to the Lake States, and to the South within the period of a single lifetime. Within 10 years it will have moved from the South to the far West, and this will be its last removal, for no other unexploited forest regions remain. The mere transfer of the forest industries is no longer the issue; their very existence is at stake. The losses and damages which go with forest devastation have always reached far beyond forest or State boundaries; today they are so widespread and so great as to involve the commerce and industry of the entire Nation.

FOREST DEVASTATION AND LABOR

Wage earners and their families dependent upon the forest and allied industries make up one-tenth of our total population. At least 2,000,000 people depend directly on the primary forest industries—logging, saw-milling, naval stores. Their condition presents one of the greatest of our internal problems, because labor conditions in the lumber industry have been notoriously bad. Housing, sanitary arragements, and hours of labor too often have been outrageous, and living conditions intolerable, and this because the lumber camp and the lumber town exist only long enough to skin the timber from the land. There is little or no permanent employment for the lumberjack in America.

Under such circumstances the woods worker easily becomes voteless, landless, womanless, homeless, and hopeless, and therefore discontented, restless, and sympathetic with destructively radical doctrines.

The conditions of forest labor need prompt and adequate attention. Past experience gives little reason to hope that the timber operators will, of their own accord, meet the situation in the open. If they do not, it is time for the public to act.

Such action should not be confined to such items as hours of labor, wages, or current living conditions. The basic trouble lies in the everlasting shifting in the location of the forest worker's job. This shifting about from camp to camp is wholly unnecessary and must be stopped before forest labor conditions can become decent and permanently fair. Whatever stops forest devastation, whatever keeps forest lands continuously at work producing timber, whatever makes the lumber industry permanent and stable rather than temporary and shifting, will help to give the forest worker a chance at a permanent job and home. When the owner of a forest is prohibited from devastating it, when he is required to make one crop of timber follow another, then, and only then, can the lumber camp and lumber town become permanent, and only then can forest labor be assured of a chance at those living conditions to which every worker is justly entitled, a chance at a real home.

FOREST DEVASTATION AND THE FARMER

The farmer is the greatest consumer of wood in the United States—more than 35 per cent of our entire production of lumber, and more than 50 per cent of our production of all kinds of wood, is used on the farm. Wood is the farmer's chief construction material. No substitute will make building so easy and rapid or fill so many of his needs. Whatever raises the price or lowers the quality of his timber supply adds to his troubles and cuts down his returns.

The farmer of the Prairie States has more interest in a permanent timber supply than any other consumer. Many a prairie farmer can yet remember the difficulties which went with sod and adobe houses and shortage in fencing and fuel. Many a one will recall the time when good white-pine fence boards were cheaper than wire. They will have noted the rapid increase in price and the steady decrease in dimensions and quality of the lumber and posts in their local markets, and they have doubtless realized that, as forest after forest disappears,

the situation will grow steadily worse. Already the shortage in cedar posts is acute.

There was a time when the eastern farmer looked upon the forest as an obstruction to be got rid of before he could put his plow to work. Brush and stumps were hard to contend against, and wood for fuel and construction was to be had for the taking. Today the farm forest plays a growing part in the profitable working of the eastern farm. The woodlots of the eastern farms contain a very large part of the total supply of hardwood left in all the United States. They are soon to become of vast importance, both to their fortunate owners and to the Nation.

To the farmer, the woodlot furnishes material for fuel, fencing, and construction, and a chance for the profitable use of otherwise slack time. The sale of surplus woodlot produce becomes constantly easier and more profitable. With the rising prices which the national shortage in good hardwood has brought about, the owner will find it increasingly to his interest to keep up his woodlot and to extend it to lands otherwise idle or of low value for other purposes. Whatever works against keeping the farm woodlot in good condition, works damage not only to the owner but to the Nation at large.

For the settler in the cut-over regions, forest devastation has created great opportunities and great dangers. Forest devastation has put many millions of acres upon the market, and has opened the way to shameless speculation and unmitigated fraud. Innocent purchasers have commonly been enticed to buy lands of little or no farm value, and then left to make a losing fight against hopeless odds. Attempts to farm low-grade cut-over land has made thousands of families into paupers.

Fertile high-grade land good for farming does exist in the cut-over regions, and taken together, there is much of it. But the great bulk of the cut-over lands are unsuited for agriculture. Because of poor soil, steep slopes, rock, severe climate, and lack of transportation and markets, many millions of acres will remain unsuited for agriculture for indefinite years. It is perfectly practicable to classify the idle forest lands of the country into those on which, at present, farming can surely be made to pay, and those upon which profitable agriculture is now dubious or impossible. But such a sorting of lands would not be permanent, for changing conditions will bring new lands into use. The great thing is to keep the land steadily at work.

So long as lands are at work and at profitable work, what crop they are raising is of minor importance. Lands which can best produce

farm crops should be kept at it. Lands which can best produce forest crops should be kept at work growing timber. If, later on, the land can be made to pay better in other crops, the most profitable crop will have the right-of-way.

We have 100 million acres of idle cut-over lands which are producing nothing and which are getting leaner with every fire that runs across them. Here and there, mixed in with the low-grade lands which make up the bulk of the cut-over regions, are irregular areas of first-class land which ought to be cleared and under the plow. Some of these tracts are ready to be used now; others will be needed later on. At present enormous quantities of poor or non-productive lands surround the areas of good soil. Any use which will put the poorer lands at profitable work will be of quick and permanent help to the settler on the good lands adjoining.

THE FORESTS OF THE FUTURE

The forests which will be raised from now on will not be tangles of wilderness, left alone for a century or so and then ripped off so as to leave the country desolate and poor. Instead, they will be carefully tended and protected and, once established, will be permanently productive. Work in the forests will become a regular and permanent business. The new forests will be cut no faster than they grow, just as the stockman keeps up his herd and still sells off his increase.

The coming of the new forests will make steady and profitable odd-time and full-time work for the neighboring settlements. With them will come more people, new wood-working industries, and local markets for farm produce. When there is pulp and cordwood, logs and lumber to be shipped out, it will be possible to get and keep such road and railroad transportation as the farming land alone could not maintain.

No island of farming, mining, or manufacturing industry can ever be as valuable in an ocean of idle waste as when surrounded by steadily productive forests. The use of the poorer soils for forest crops will be profitable to the men and women who are engaged in every sort of occupation, for it will cut down the cost of living and increase the general wealth. But before that can happen forest devastation must stop.

II

THE PROPOSED PLAN

(*A*). A forest policy for the United States should be based upon the following *fundamental principles:*

1. PROSPERITY IN PEACE AND SAFETY IN WAR REQUIRE A GENEROUS AND UNFAILING SUPPLY OF FOREST PRODUCTS.

2. THE NATIONAL TIMBER SUPPLY MUST BE MADE SECURE—

(*a*) By forbidding the devastation of private forest lands and by promoting the conditions necessary to keep these lands permanently productive; and

(*b*) By the production of forest crops on public forests owned and operated by communities, States, and the Nation.

3. THE TRANSFORMATION OF PRODUCTIVE FORESTS INTO IDLE WASTES IMPOVERISHES THE NATION, DAMAGES THE INDIVIDUAL, IS WHOLLY NEEDLESS, AND MUST BE STOPPED.

The public must safeguard its own interests and perpetuate the forest industries by preventing such devastation and by the acquisition and intelligent handling of forest lands for public purposes.

Although the fact and the effect of converting forests into wastes have been set and kept before the lumbermen for more than a generation, their practice of forest devastation has remained and is today unchanged. The time has come when the public must act in its own defense. It appears to be true that the support of the lumber industry as now organized and inspired can not be expected for any effective plan aimed at putting an end to the making of wastes out of productive privately owned forest lands.

4. UNLESS AND UNTIL LANDS CAN BE MORE PROFITABLY EMPLOYED FOR OTHER PURPOSES THEY SHOULD BE USED TO PRODUCE FOREST CROPS IN ORDER—

(*a*) That forest products may be produced near to centers of consumption, thus reducing the length of haul, minimizing freight expense, and setting free the labor, equipment, supplies, and power otherwise expended in moving forest products great distances. This will reduce the strain on our system of transportation and wisely and materially affect, maintain, and regulate interstate commerce.

(*b*) That the flow of navigable streams may be regulated by minimizing floods, drought, erosion, and silting, thus favorably affecting navigation, irrigation, water power, and manufacturing and domestic water supplies.

(*c*) That a supply of lumber and other forest products essential to meet the needs of home industry and furnish a surplus for export may not fail, thus helping to create and preserve permanent and nation-wide prosperity.

(*d*) That lumber and other forest products may be plentiful and reasonable in price, thus helping to hold down the cost of living, especially the cost of houses and fuel.

(*e*) That the people living in and adjacent to forests may have permanent occupation, and that wood manufacturing plants may have permanent supplies of raw material; thus increasing production and consumption, creating and maintaining permanently prosperous homes and industries, and abolishing the present crying evils of hobo labor in forest regions.

(*f*) That we may conserve for every part of our country the advantages of hunting and fishing and of recreation and public health found in well-forested regions.

5. THE OWNERSHIP OF FOREST LAND CARRIES WITH IT A SPECIAL OBLIGATION NOT TO INJURE THE PUBLIC.

Timber is a long-time crop. The public interest requires the continuous production of forest crops. Injuries to the productive power of the forest are lasting and often can not be repaired for generations. The general welfare, therefore, is directly affected by the maintenance or destruction of the productive and protective power of forest land.

The lumber business has been so conducted in the woods as to inflict great and lasting injury upon the public. Except for adopting, in some regions, better measures for protecting uncut timberlands against fire, almost without exception the lumber business has been managed wholly without regard to keeping its lands productive and has thus jeopardized the general prosperity.

6. THE SECURE AND STEADY OPERATION OF THE LUMBER INDUSTRY IS OF VITAL CONCERN TO THE PUBLIC. To this end—

(*a*) The Government should always be fully informed on the chief facts relating to the business condition of the lumber industry.

(*b*) Machinery should be created for the interchange of views and the adjustment of differences arising between labor, management, and the public.

(*c*) The Government should be empowered to control lumber production in times of economic stress.

7. THE LUMBER INDUSTRY BEING NATION-WIDE, UNIFORM AND ADEQUATE CONTROL OVER IT MUST BE NATIONAL.

The separate States can not effectively subdivide and deal with either the legislative or the executive control of this distinctively interstate question.

The administrative charge and direction of the effort to replace the temporary and destructive methods of lumbering now in use by a system of continuing production should be entrusted to the National Government.

Although their co-operation is highly essential, it would be impossible or impracticable to obtain through the States uniform and simultaneous legislation, nor are the economic and technical problems involved limited or separated by State lines. The problem is national and can be handled only as such.

8. NATIONAL LEGISLATION TO PREVENT FOREST DEVASTATION SHOULD HAVE THREE OBJECTS:

(*a*) Such public control over private forest lands and only such as may be necessary to prevent the continued devastation of forests and insure the continuous production of forest crops on lands which would otherwise be idle.

(*b*) Such public control and only such as may be necessary to place forest industries on a stable basis in harmony with public interests.

(*c*) The transfer of control back to the forest industries as soon as they become able and willing to assume responsibility for respecting the public interests, the Government retaining a supervisory function with full authority to renew its control at any time if the public interest so demands.

9. THE NATIONAL, STATE, AND COMMUNITY FORESTS SHOULD BE MAINTAINED AND LARGELY INCREASED.

(NOTE—The foregoing principles, as their application is here recommended, do not apply and are not intended to apply to farm woodlots.)

III

SUGGESTED LEGISLATION

(*B*). National legislation in furtherance of the proposed plan should include the enactment of a Federal law:

1. Creating a Commission, to consist of the Secretary of Agriculture, the Secretary of Labor, and the Chairman of the Federal Trade Commission, with the duty of making such rules, regulations, and decisions for the administration of the law as may be necessary, the Secretary of Agriculture to be Chairman of the Commission and the execution of the law to rest with the Forest Service under his direction.

2. Authorizing the Commission:

(*a*) To establish regional administrative organizations to coincide with the principal forest regions of the country, such organizations to be in charge of regional foresters to whom the Secretary of Agriculture, through the Forester, would delegate such authority as may be necessary for the prompt execution of the law in accord with local conditions and needs. The regional foresters would be authorized to explain the requirements of the law and regulations and to secure compliance or report non-compliance with them. Representatives of the Federal Trade Commission and the Department of Labor would be assigned to the several forest regions as might become necessary to co-operate in the administration of the law.

(*b*) To fix standards and promulgate rules to prevent the devastation and provide for the perpetuation of forest growth and the production of forest crops on privately owned timberlands operated for commercial purposes; but the Commission should not enforce such rules and standards upon farm woodlots nor upon other areas which in its judgment may be exempted with safety to the public interests.

The standards should relate to principles and general methods only, the greatest possible elasticity being allowed in their application to varying local forest conditions. The object of standardization should be to put an end to forest devastation, and to place the lumber industry on a uniform basis throughout the country as a whole. The object of local regulation should be to provide for forest protection and perpetuation in a manner fitted to local forest requirements.

(*c*) To require standardized accounting systems; periodical reports on production, orders, shipments, sales, distribution, stocks on hand, costs of production, and returns; and a special account of the increased costs, if any, of regulated over unregulated logging, showing also the direct and indirect gains under regulation. The Federal Trade Commission would assign such field agents to this work as might be necessary to obtain accurate results.

(*d*) To withdraw its supervision and make only such occasional inspections as may be necessary, whenever an organized forest unit proves itself capable of taking direct charge of the work of forest protection and perpetuation in its forests and gives assurance that the standards attained will be continued.

The Government would retain power to renew its supervision in case the public welfare so demanded.

(*e*) To control production whenever such action is necessary for the public good in times of economic stress.

(*f*) To sanction the co-operative combination of lumber manufacturers for all purposes resulting in economies in production and marketing whenever, in the judgment of the Commission, such co-operative combination will promote the public interest.

(*g*) To acquire for the United States the title or control of forest lands, both timbered and cut-over—

1. By purchase of the entire fee or of surface rights.
2. By a system of long-time leases.
3. By designating general areas within which title to all forest lands should pass to the Government by condemnation upon the completion of logging operations.

(Compensation under the above methods should be made either from funds appropriated or from the sale of long-term serial bonds.)

4. By gift.
5. By defraying the additional expenses of regulated logging as a means of acquiring title or control.
6. By the issuance of certificates receivable in payment for National Forest timber, ripe and approved for cutting, to be cut under National Forest rules and regulations, such certificates to be used for the purchase of the title to land (entire fee or surface) and timber privately owned within or adjacent

to National Forests, values to be established by Government appraisal.

Since lands of the United States are not taxable, the Commission should compensate the counties for losses in taxation caused by the transfer of title to the Nation.

(*h*) To co-operate with the several States—

1. For the protection of forests against fire and other enemies and for largely increased financial assistance to the States from the National Government for that purpose, under definite standards of efficiency.

2. For promoting the purchase or acquisition of private forest lands by the Nation, the States, or by communities.

3. For a uniform system of state forest taxation aimed at the best use of the land. Such legislation might include both measures for deferred taxation on standing timber and the placing of a sur-tax on forest land not protected and managed in substantial conformity with the national and state laws and with the standards and regulations promulgated by the Commission or by corresponding state authority.

3. Authorizing the Secretary of Agriculture to carry on such operations on the National Forests as may be necessary to harvest and market forest products.

4. Authorizing the establishment of adequate forest insurance agencies. These would be important factors in stabilizing the industry and would tend to bring about more thorough-going protection against fire.

5. Authorizing the creation of a National Forest Loan Board and Forest Loan Banks. This would enable the lumber industry to borrow on more equitable terms than at present, thus materially decreasing carrying charges.

6. Granting official recognition to regional and national councils of lumber employers and employees, chosen respectively by the operators and the workmen; and to joint regional and joint national councils of the regional and national employers and employees councils combined; or creating equivalent agencies under conditions and regulations promulgated by the Commission.

Among the functions of these councils would be to consider and adjust such matters as wage rates, overtime, hours of employment, leaves, housing, board, insurance, and the participation of employees in matters

relating to conditions of employment, and other questions between and concerning the relations of employers and employees to each other.

7. Providing, with appropriate penalties, for the enforcement of the law:

(*a*) By preventing the cutting or removal of forest products from commercial forest lands contrary to the provisions of the law, the standards, and regulations; and/or

(*b*) By requiring a Federal license, to be obtained by concerns engaged in interstate commerce, without which forest products may not be cut or removed from commercial forest lands; and/or

(*c*) By preventing the cutting or removal of forest products from commercial forest lands on the watershed of any navigable stream contrary to the provisions of the law, standards, and regulations; and/or

(*d*) By means of a tax on the incomes of those who cut or remove forest products from commercial forest lands in violation of the law, standards, and regulations, or on the lumber thus cut.

COMMITTEE FOR THE APPLICATION OF FORESTRY.

GIFFORD PINCHOT, *Chairman*.
DONALD BRUCE.
R. C. BRYANT.
B. P. KIRKLAND.
P. S. LOVEJOY.
F. A. SILCOX.
J. W. TOUMEY.
G. W. WOODRUFF.
F. E. OLMSTED, *ex-officio*.

ADVISORY COMMITTEE.

CHARLES S. BARRETT.
JOSEPH H. PRATT.
CLYDE L. KING.
HERBERT K. SMITH.

Messrs. Bruce and Toumey desire that the following reservations should be understood as accompanying their signatures.

On the part of Donald Bruce:

While I heartily favor the plan of legislation outlined in this report, I believe that the support and advice of the most progressive thought of the lumber industry should be sought before proposing it to the

public. It is my belief that the lumber industry is not to be held responsible for existing conditions. The blame for this lies on the nation as a whole and on its former unwise land laws from which the lumber industry as well as the public has suffered. I believe that the lumbermen ought to be consulted in regard to the proposed plan that there may be less chance of unintended injustice to their interests and also because their experience will be of great value in making private forestry practicable.

On the part of J. W. Toumey:

Although I approve of the general summary of conditions as to American forests and future timber supplies which might be termed the preamble of the report and for this reason signed it, I am not entirely in accord with the fundamental principles set forth in Part II nor with the legislation suggested in Part III.

Regarding the fundamental principles set forth under *the proposed plan* (Part II) I agree with Articles 1, 2, 3, 4, and 5, together with each paragraph under them with the following substitutions and additions.

Article 2. Paragraph (*a*). The substitution of the word checking for the word forbidding in the first line.

Paragraph (*b*). The addition of the word promoting in the first line to read, by promoting the production of forest crops, etc.

Article 6. The elimination of this article. I am unalterably opposed in the report to matters relating to the adjustment between labor, management and the public and projects for the governmental control of lumber production.

Article 7. I propose the following as a substitute for this article. Whatever control is exercised by the Nation over privately-owned timberland must be by the Federal government acting in conjunction with and through the several States.

The administrative charge of directing the effort to replace the present destructive methods of lumbering by a system of continuous production must be entrusted to the States. State legislatures must provide certain minimum requirements in forest protection and forest renewal and both the State and National governments provide substantial assistance to private owners in making effective a system of management for each locality that will result in sustained yield.

Article 8. The elimination of the word national from the first line of the article and the change of the word three to two in the second line to read, legislation to prevent forest devastation should have two objects. The elimination of paragraph (*b*) from the article.

Article 9. This article meets my approval as it stands.

The note at the close of Part II which provides for the non-application of the principles set forth in the nine articles of the proposed plan to farmers' woodlots is wrong in principle and should be eliminated. I do not believe that woodlots can be considered separately from other forms of forest property in matters of National and State legislation.

Regarding the suggested legislation (Part III) I oppose the principles set forth in many of the paragraphs. I propose the following as a substitute for Part III of the report of the committee:

National legislation in furtherance of the proposed plan should include the enactment of a Federal law:

Article I. Creating a commission of five members with the Secretary of Agriculture as Chairman and the Chief Forester of the United States as Secretary with the duty of making such rules, regulations and decisions for the administration of the law as may be necessary; the execution of the law to rest with the United States Forest Service under the direction of the commission.

Article II. Authorizing the commission:

(*a*). To co-operate with and aid the several States in securing State legislation which, with financial support by the public will make sustained yield on privately-owned forest lands possible.

(*b*). To co-operate with and aid the private owners of timberland to attain sustained yield. This co-operation and aid to be exercised through the several States: the commission to call upon the States for the submission of plans for effective forestry within their boundaries. If the plans submitted by the State are accepted by the commission and agencies are organized to execute them, the commission to aid the work by liberal financial support from a special national appropriation for this purpose, thus recognizing the incontrovertible fact that as forests are essential for the public welfare the public must render financial aid in putting into operation any plan that places private forests under sustained yield and from which the public benefits as well as the private individual. Assistance by the commission to be contingent upon the States establishing certain minimum requirements acceptable to the commission which will apply to all forests alike. The commission to exercise co-operation and aid—

1st. In increasing the standards and requirements in fire protection because of the inadequacy of present standards and requirements.

2d. In land classification because any plan that involves forest replacement must be preceded by land classification.

3d. In forest renewal by natural and artificial means because this is the foundation of sustained yield.

4th. In providing technical assistance in organizing private forests for sustained yield.

5th. In establishing a system of forest taxation which levies an annual tax on the land and a yield tax on the timber when it is cut.

6th. In developing forest units for sustained yield under multiple private ownership and private and public ownership combined.

7th. In promoting the acquisition of private forest land by the States and communities.

(*c*). To acquire for the United States the title or control of forest lands both timbered and cut over:

1st. By purchase of the entire fee or of surface right.

2d. By a system of long-time leases.

3d. By designation general areas within which title to all forest lands should pass to the Government by condemnation upon the completion of cutting operations.

4th. By gift.

5th. By defraying the additional expenses of regulated logging in designated general areas as a means of acquiring title or control.

6th. By the issuance of certificates receivable in payment for National Forest timber, ripe and approved for cutting, to be cut under National Forest rules and regulations, such certificates to be used for the purchase of title to land (entire fee or surface) and forest areas privately owned within or adjacent to National Forests, figures to be established by Government appraisal.

(*d*.) To secure long-time loans on private forest property at low rates of interest through a credit system similar to that to farmers through the Federal Farm Loan payments.

(*e*). To co-operate and aid in working out an acceptable forest fire insurance system.

Article III. Providing with appropriate penalties for the enforcement of the law.

The penalty for non-enforcement of minimum requirements by the States to be the withholding of all financial aid by the Federal government.

AN ANSWER TO DR. COMPTON'S FOURTEEN POINTS

In a recent issue of the *American Lumberman* and later in *American Forestry,* Dr. Wilson Compton, Secretary-Manager of the National Lumber Manufacturers' Association, attempts as a *lawyer, economist, and plain citizen,* to justify the opposition of the lumber industry to the growing popular sentiment in favor of preventing devastation of privately owned timberlands. Emulating an illustrious leader, Dr. Compton expands his arguments to fourteen basic principles. As a lawyer who must present a brief for his client, the Lumber Manufacturers' Association, he is entitled to a hearing. We doubt, however, whatever lawyers may think, whether economists and plain citizens would recognize in him their spokesman.

As an economist, he belongs to the almost obsolete school which places "the self-interest of individuals" above human progress. As a plain citizen, he is too manifestly on the side of a few individual timberland owners and against the interests of the great mass of the people. As an economist he should deal with facts and not with hypothetical cases. He sets up a straw man which he presents as the sentiment of the forestry profession, and then proceeds to demolish it. These views which he attacks and which he imputes to a majority of foresters are based upon "personal conversation and correspondence," and not upon published material by foresters both within and outside of the Government service. Taken by themselves, his "principles" are so general that few will controvert them. It is their interpretation and application to actual conditions that reveal his true viewpoint and purpose. We personally feel that he does more harm than good to the lumber industry, by placing it in an uncompromising attitude toward a popular movement which can no longer be delayed by legalistic arguments or by economic casuistry.

After our experience in the war, after recent enactments such as the prohibition amendment, narcotic drugs act, the abolition of manufacture of sulphur matches, laws intended to curb the social evil, all of which "discourage enterprise and seriously impair the efficiency of the particular industries thus singled out," Dr. Compton is not reckoning with the times when he demands "hands off the lumber industry!" and insists upon self-interest as the controlling factor in

our economic life. The people are no longer in a mood to apply as a test of the desirability of an economic reform whether it puts more money in the pocket of the private owner or not. They will demand that the timberland owners find a way to prevent devastation of timberlands, and if the owners cannot, then the people will.

Let us take up Dr. Compton's arguments point by point:

1. *"There are already local shortages of standing timber and there will be more. The removal of the original forests from the soil of the United States without provision for forest renewal on much ('most' in American Forestry) of the land thus cleared is not necessarily a public misfortune."*

If by this statement Dr. Compton means to convey the impression that it was a natural and healthy economic development, as population and industries increased, to remove a great part of the virgin forests to make room for settlement, agriculture, or other industries, no one will quarrel with him. Anyone, however, who is in the least familiar with the history of the lumber industry in this country knows that the clearing of the virgin forest in most cases was not followed by settlement, and left in its wake nothing but enormous stretches of unproductive waste land. "The removal of the original forests without provision for forest renewal on much of the land thus cleared" *has been and is a "public misfortune."*

The local shortages of raw material, which he admits are already with us and are bound to grow, cannot therefore be excused on the ground of "a higher economic necessity" because in most cases they are not accompanied by other economic development. If Dr. Compton followed the forest literature he would know that foresters for the last 20 or 30 years have advocated that the soils of the United States be devoted to the uses to which they are best suited. They therefore could never consider as a misfortune but as a healthy economic development the removal of virgin forest from agricultural soils which since have been settled. They deplore the policy and still insist that it is unwise economically, although profitable to the lumbermen, of removing forests from soils which are too poor or too rocky to be used for any other purpose but growing forests. It is the old accusation of land speculators that timber growing blocks settlement and economic progress, yet it is the very removal of the forest and elimination of the lumber industry, especially in a region of poor soils, that prevents or retards settlement. In Europe, particularly in

Scotland and France and the Baltic regions, it was only the forests with their dependent industries, the source of income to the local population, that made possible the settlement of the poorer land. Agriculture, and particularly timber growing, are industries of a special character, and are recognized as such by most prominent economists. No region of any size can deprive itself of near-by sources of food and wood without finding itself at an enormous economic disadvantage. This is especially true of wood, which is a bulky product and whose cost of transportation over a considerable distance may exceed the cost of the material itself. England, of all countries, if Dr. Compton's assertions were correct, could afford to depend for its timber supply upon its neighbors, such as Scandinavia and Russia. Those countries are much nearer to centers of consumption in England than are the supplies of timber on the Pacific Coast to our centers of consumption in the East and Middle West. England has unequalled facilities for cheap water transportation. It is a densely settled country and industrially one of the most developed, yet it found itself compelled by circumstances to embark upon a costly reforestation program to grow part of its own timber supplies. We speak here of home grown timber merely as a source of raw material, and leave out the not less important function of the forest which makes it to a large extent a local necessity as a watershed cover and protection to agriculture. Dr. Compton asserts that while there are local shortages of *timber* there are no local shortages of *lumber,* evidently meaning that any locality can buy all the lumber it wants. Technically he may be right, and we doubt if there will ever come a time when lumber cannot be bought, no matter where it may have been produced, as long as the buyer is willing and able to pay the price. In this sense there is very seldom an actual physical exhaustion of any particular product, because as long as there are people who can pay the price it will be obtained in some way.

We do not believe that there will ever be in this country a lumber famine in the sense that lumber cannot be obtained at any price. The shortages of lumber, particularly of certain kinds, will be reflected in prices of lumber. This is the barometer by which we can judge whether the supply is abundant or scarce. This is so self-evident that Dr. Compton himself, evidently forgetting what he said before, admits a "decline in lumber production, because of increasing scarcity of its raw materials . . . facts which everyone can observe" (see point 4) and again, a very unfortunate (for Dr. Compton) admission

in point 8, "The increasing scarcity of raw material," which has resulted in "higher prices for the products of the forest." Dr. Compton therefore cannot lightly dispose of the local shortages of timber on the ground that it can be grown somewhere else. It does not matter to the private timber owner how far he ships his lumber, as long as the buyer pays the freight. It does vitally affect the local community, and through it the nation as a whole, to have to pay high prices for lumber, because of increasing distance of the sources of supply, while near at hand are hundreds of thousands or millions of acres of idle land, producing nothing and constituting a burden upon the community. If Dr. Compton's argument be followed to a logical conclusion, why worry about a lumber shortage at all? After the timber owners on the Pacific Coast have devastated the forests of that region, the people of this country may still get lumber from Siberia, South America, or Central Africa, provided they are willing and able to pay the price. We doubt whether there is a single economist in this country who could advocate such a theory with regard to any natural resource, without risking his reputation or his integrity.

2. *"Possession of cheap and plentiful standing timber is not necessarily a symptom of national wealth."*

Taken by itself this statement is confusing. In a highly developed country with a dense population the maintenance of a large forest area on land needed for other purposes is as economic folly. We cannot conceive of such a condition in any modern society, particularly in countries which do not have a landed nobility. In Germany, Austria, and other parts of central Europe, there may have been large areas kept in forest for game preserves and withheld from other use. In democratic countries like ours, however, where the operation of economic laws has freer sway, the withholding of lands from higher use is bound to break down sooner or later, and the land will find the use to which it is best adapted. There are now large areas of cut-over land, much of it not suited for agriculture, in the hands of lumber and land companies. These lands are being unloaded on settlers, who in many cases eventually lose their earnings and abandon their lands. Those owners of cut-over lands who try to apply them to a use for which they are unfit are the ones who prevent an orderly economic development. Such non-agricultural lands, possibly after much suffering and loss on the part of those who

attempt to cultivate them, are bound to eventually revert to the use for which they are best suited, the growing of timber. If Dr. Compton will only take the trouble to look into the ownership of cut-over lands which are being withheld from their highest economic use, namely the production of timber, he will find that they are largely owned by lumber companies.

As far as it applies to the United States, which is probably what Dr. Compton had in mind, the statement has no force whatever. We have no longer a cheap and plentiful supply of standing timber in this country. He admits this himself. As a matter of fact, the reverse is true. We are suffering from an abundance of unproductive land. If an abundance of forests in a highly developed country may not necessarily be a sign of national wealth, an abundance of unproductive land is certainly a great social and economic menace.

As for backward, thinly settled and poorly developed countries, abundant forests are certainly an element of national wealth. Where would be the economic strength of Finland and Sweden today, 50 per cent of whose areas are covered with forests, were it not for their timber resources? The same is true of many other countries, such as Russia and some of the newly established central European states. It is their timber that will rehabilitate their economic life. Dr. Compton evidently forgets the part played by "cheap and plentiful standing timber" in the early development of our own country. If in making this pronouncement he levels his attack against an imaginary opponent who advocates planting up Pittsburgh or New York City to forests, his indignation is fully justified, but we are afraid he is fighting windmills.

3. *"The virtual disappearance of certain species of timber is not necessarily detrimental to the public welfare."*

If Dr. Compton really meant what he said we would be willing to subscribe to his statement. We have been contending for years that when our forests are placed under management we may have to confine ourselves in each region to the growing of a few species which, because of their adaptability to the climate and soil, quality of timber, rapidity of growth and large yields, prove the most desirable ones to produce. The trouble, however, is that Dr. Compton means by his statement to justify the practical exhaustion of the most valuable species of this continent, the cream of our virgin forests. What he really means to say is, "Why worry about the depletion of the south-

ern yellow pine? When it is gone, we shall use Douglas fir. When walnut, hickory, and ash are gone we may use in their places some other hardwood species from our forests." Such optimism is not warranted by facts. Our hickory is nearly gone and the vehicle manufacturers have not yet discovered a fully satisfactory substitute among our numerous hardwood species. They are searching the tropical forests of Mexico, South America, and even central Africa for substitutes. We are afraid it will be hard to convince the users of vehicles that the ruthless cutting out of the hickory was not detrimental to their interests. The same is true to a large extent of ash, yellow poplar and black walnut. The difference between eliminating certain species from forests managed by foresters, and the elimination of certain kinds of trees from our forests by present methods of lumbering is that they work in diametrically opposite directions. The foresters try to eliminate the inferior species, and build up a forest of the more valuable kinds. The lumberman culls out the choicest and best kinds, and leaves the inferior ones to form the future forest. It will be a great economic loss to completely cut out the southern pines, particularly the longleaf, because so far we do not know of a single species that could do as well and be as valuable, both on account of its timber and resin, as the longleaf pine. While European countries are searching out our valuable species such as longleaf pine, walnut, Douglas fir, and introducing them in their own forests, the "economists" of the lumber industry want us to believe that their virtual disappearance is not detrimental to the public welfare.

4. *"The cutting down of old trees faster than new trees are growing up does not of itself signify public loss."*

If provision is made for replacement of the old growth by new forests in amounts sufficient to meet the needs of the country for forest products, the removal of the mature forest even at a more rapid rate than the new growth comes up, may be justified. Without such provision, removal of the mature forest can lead to nothing but destruction of the forest resources, and that is where the lumber industry is headed. Dr. Compton is an optimist when it comes to our future needs for lumber. He contrasts the per capita consumption of lumber in the United States and in Germany and hopefully predicts that some day we may come to Germany's level. Since that would mean a great reduction in our per capita lumber consumption,

he concludes that we shall not need as much lumber in the future as we have used in the past, and even goes so far as to admit that the country would probably be better off if it used substitutes instead of wood. We wonder what Dr. Compton, the Secretary-Manager of the National Lumber Manufacturers' Association, who conducts campaigns against wood substitutes, will say to Dr. Compton, "the economist," who thus provides advertising ammunition for the manufacturers of these substitutes? We are perfectly willing to agree with Dr. Compton that "the decline in lumber production because of increasing scarcity of its raw material, the consequent shifting of demand and the increase in prices of lumber, are facts which everyone can observe." But we cannot deduce from this that if the supply of timber had been maintained, and if other conditions had not also contributed to increase prices to abnormal levels, the demand for lumber would have decreased at all. It is, of course, obvious that the less lumber is produced, the less there will be consumed. We hardly believe that real economists would agree that just because Great Britain, Germany, and some other countries use less lumber per capita than does the United States, it necessarily follows that they are any better off for it. Few Americans familiar with standards of housing in many of the rural regions of Europe would care to have similar conditions exist in our own country. Moreover, Dr. Compton forgets that even if per capita demand for lumber should decrease to some extent in the course of a few decades, the population of the country may be expected to increase. Even with a reasonable allowance for a decline in the rate of population increase, and allowing a steady decrease in requirements for lumber which will bring us down to but little more than 150 board feet per capita (Germany's present level) within the next 60 or 75 years, our total requirements will then still be as great as they are now. Whether there will be lumber to supply these demands is another matter.

When Dr. Compton undertakes excursions into the field of technical forestry, he is entirely out of his sphere. We can inform him that the annual increment is nearer 35 billion than 20 billion board feet per year. This, however, is total annual growth, and should be compared with the total annual cut of wood, which is approximately 110 billion feet. The annual growth of sawlog material, which is what he evidently had in mind, is not over 9 billion feet a year. If we deduct from this the losses from fires, insects, fungi, storms, and other causes amounting to at least 2 billion feet of saw timber per

year, the net annual increment of saw material is not more than 7 billion feet instead of the 20 billion feet guessed by Dr. Compton. We are therefore cutting saw timber five times as fast as we grow it. Comparing the total stand of timber of sawlog size, a little less than 2,500 billion board feet, with the total annual cut of all material of this size, 60 billion board feet, there would seem to be in sight a supply of timber that would last only between 50 and 60 years, instead of the 150 years predicted by Dr. Compton. The prospect therefore is that in from 60 to 75 years our requirements for lumber will be about the same as now while the reserve supply of merchantable material will be entirely exhausted and the amount supplied by growth will furnish only from one-fifth to one-third of these requirements.

Dr. Compton's statement that a lessened demand for lumber has characterized the industrial development of other countries, such as Germany and Great Britain, is, unfortunately for his argument, quite the reverse of the actual facts. In spite of the fact that production from Germany's forests has doubled in volume within the past century, her imports of lumber from other countries have steadily increased in amount. In Great Britain not only has the total consumption of lumber *increased* five-fold during the period 1851-1911, but even the *per capita consumption has steadily increased*, and in 1911 was more than *three times* what it was 60 years before.[1] Against Dr. Compton's assertion, based apparently on opinion or "conversations" with some one who was ignorant of the facts, we may set this statement of the Forestry Branch of the British Government, which is backed up by actual figures: "There are factors—such as the preservative treatment of wood and the substitution of other materials for constructional purposes—which may tend to check the consumption of timber, but it is a feature of modern commercial progress that in spite of this the consumption per capita is steadly increasing." The economic pressure for increasing quantities of wood has forced practically every European country, even densely populated industrial nations like Belgium, to ncrease the areas under forest and to adopt more and more intensive methods of forestry in order to stimulate production of timber.

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[1]Joint Annual Report of the Forestry Branches, 1912-13. London, 1914. *Per capita consumption of imported timber in United Kingdom.*

Year	Population (millions)	Loads of timber (per capita)
1851	27.7	.07—
1861	29.3	.09+
1871	31.8	.13+
1881	35.2	.17—
1891	38.1	.17+
1901	42.0	.21—
1911	45.4	.21+

Between 95 and 100 per cent of all lumber used in United Kingdom is imported material, so that consumption of home-grown lumber will not materially affect these figures.

5. *"Not only is it not necessarily, but it is not even probably true, that all the lands in the United States locally determined to be better suited for growing trees than for growing anything else, should be used for growing trees."*

Dr. Compton attempts to demonstrate the truth of this statement by asking the following question: "If 95 per cent of the land of the United States were thus determined to be better suited for pasture land than for any other purpose, would 95 per cent be used for that purpose and we become a nation of herdsmen?" His argument is on a par with this: "If all the streets of Chicago were paved with chocolate gum-drops, would they be sticky after a rain?"

Dr. Compton is evidently afraid of facts, and justly so, because they do not fit in well with the arguments he tries to make. The proportion of area under forest in the United States is very nearly the same as in Germany, a little more than one-fourth. Moreover, the German forest area is actually producing timber, and yet, in spite of the small per capita consumption of wood in that country, it produces barely two-thirds of the wood needed for domestic consumption.

In fact, much of the area classed as forest land in this country is not best adapted for timber production in the future, and will not become a part of the future forest lands. We have therefore actually a smaller proportion of forest land than Germany. It is ridiculous, in view of our present large per capita consumption and poorly managed forest lands, to assume that we have more timberland than we need. The existing shortage of houses, estimated at a million or more, together with the present high prices for lumber which put it almost out of the reach of ordinary buyers and which are due, Dr. Compton asserts, to growing scarcity of timber, does not indicate that the country needs to fear the awful prospect of producing lumber to "house five times the number of people it could feed," even if the 400 or 450

million acres suitable to grow timber are put under forest management without delay. It has become almost axiomatic with the economists of Europe (although we think faultily) that an area in forests equal to one-fourth of the total land area constitutes the minimum essential for the welfare of a country, both for supplies of raw material and because of the effect of forests on the surrounding region.

6. *"The disappearance of forest industries in certain regions because of exhaustion of nearby timber supplies is not necessarily either a local or national misfortune."*

Disappearance of forest industries is not necessarily a misfortune, *providing* that there is something to take their place. In many localities denuded by the lumber industry nothing has or can take the place of forest production. It should not be forgotten that labor and capital cannot produce wealth by themselves—they must have raw material, that is, land or its products—to work with. It is an economic waste to let land be idle and non-productive when with a very small outlay of labor and capital it could continuously produce raw materials to keep other labor and capital profitably employed.

Of the approximately 380 million acres of cut-over land in the country, 100 million acres are unproductive wastes. Would Dr. Compton contend that these 100 million acres are not an economic waste? The trouble with his argument is that he fails to understand that there is an essential difference between the lumber industry and other manufacturing industries. Manufacture of hats, for instance, may be transferred from one locality to another, with comparatively small loss to the nation or to the locality. It is economic folly to argue that the production of lumber can be concentrated on the North Pacific Coast or the production of all our food in the Central Prairie region. The production of both agricultural and forest crops needs large areas of land and a product of the soil can be replaced in our economic life only with other products of the same soil. If agriculture does not follow timber growing, as it seldom does on poor soils, or other forest growth does not follow, the land is non-productive and therefore an absolute economic waste. It is not merely because of "local pride" that the Lake States should deplore the reduction to sandy deserts of once magnificent forests of valuable species. It is because of the desolate villages, decrease in population and general economic ruin for the entire region.

7. *"Economically the original timber in the United States is in large part a 'mine' and not a 'crop.'"*

Whether by "fortuitous circumstances" or not, the fact remains that three-fourths of our timberlands, the most valuable and accessible, are in the hands of private owners; that 11 per cent are in the hands of 3 owners; 22 owners hold roughly 25 per cent of the timber, and 195 hold almost half. Three great companies own 23 per cent of the timber in the Pacific Northwest. Certain big holders "control great acreages near their own timber in a manner not characterized by philanthropy." Every industrial depression in the lumber industry increases the concentration of ownership in fewer hands. Most of these timber holders are also operators and producers of lumber. Dr. Compton, who has studied costs of lumber production, probably knows as well as anyone that most of the fortunes made in the lumber business came as a rule not from logging and milling but from speculation in stumpage. Under these circumstances it will be difficult even for Dr. Compton to relieve the lumbermen who own these timberlands from the moral and social, if not legal, obligations that ownership of a basic natural resource involves.

If the manufacturers of lumber did not own the timberlands, the growing of timber would not be their business. If the millers owned the wheat fields, whose business would it be to grow the wheat? Suppose the farmers as a class, not as individuals, refused to use their lands to raise crops because they could make more money by engaging in some other business, how long before there would be recognized moral and social anl even legal obligation to put the farm lands to use for food production?

There is this important difference between farmers and lumbermen. Most farm owners, whether they practice poor or good farming, attempt to keep their land in a productive condition. Even though farmers as a class, at least until recently, have received an extremely low rate of return on their investment compared with that received in other industrial lines, they realize that it is to their "self-interest," of which Dr. Compton is such an advocate—to keep their land productive, while timber owners who are harvesting a crop which was a free gift of nature, do not concern themselves with keeping the land productive.

There are already enough data on hand to show that the growing of timber by private owners is at least as profitable an enterprise as the growing of crops. Mr. Bartlett, in a recent issue of the *Ameri-*

can Lumberman, stated that in the New England States no other crop in the last 20 years has paid half as well as the growing of timber. Better reasons are needed than those so far advanced, to excuse lumbermen who are timber owners from the moral, social or legal obligation to keep in forest production such of their lands as are not suited for any other use, even though they do not receive speculative returns on their investment.

There may have been some justification in the past in using much of the original billion acres of timberland in the United States as a mine rather than as a crop, since it was on land needed for agriculture. We are not dealing now with the past but with the present. Are we justified, in view of the shortage of raw material, and the vast acreage of idle lands, frankly admitted by Dr. Compton himself, to use our remaining timber resources as a mine?

8. *"Local shrinkage of employment for labor, caused by vanishing forest industries in certain regions, has been by no means an unmixed evil for labor."*

This is an attempt to becloud the argument by basing it on an assumption which is contrary to actual facts. If disappearance of the lumber industry in one region were offset by a general expansion of the industry in the country as a whole, and if the supply of labor were stationary or increasing less rapidly than the demand for it, the idle labor released in one region might be absorbed elsewhere, and if the growth of the industry as a whole were more rapid than the local shrinkage, it might have led to increased wages. It is true that transfer of lumbering from the East to the West did result in higher wages, because labor in the West has been less plentiful than in the East, when all the demands for it are considered. But this has not benefited the lumberjack, since the costs of things he had to buy were high in proportion, so that it is to be doubted whether his wages have enabled him to enjoy any higher standard of living in the West than in the East. The migratory character of labor in the lumber industry would rather tend to indicate that the real wage level of the lumberjack is about the same in the different producing regions. But now the lumber industry as a whole is shrinking. In the State of Pennsylvania 20 years ago 23,000 men were employed in the logging camps and sawmills. Today less than 10,000 are so employed. In Michigan less than 20,000 men work in camps and sawmills, as against nearly 50,000 thirty years ago. Similar conditions apply to the entire Northeast.

If the disappearance of the lumber industry had been followed as a rule by other economic development to use the land left vacant, the idle labor could have been absorbed in the new industries. The truth is, however, that passing of lumbering in given regions has not opened the way in most cases for other development, but has resulted even in the transfer of many industries dependent on the forest resources to other regions.

It is certainly a novel theory that "higher prices for the products of the forest, *resulting from the increasing scarcity of the raw material*, have made possible the payment of higher wages." It is contrary to the assertions of the industry, very vehement at times, that the high prices of forest products are due to the high cost of labor and equipment rather than to scarcity of raw materials, and that prices can be lowered only if wages come down. Just now the normal relation between demand and production has been upset, and the excessive demand for lumber, making prices much higher than would be justified by scarcity of raw material alone, enables the manufacturer to reap unusually large profits. He may not only be able, therefore, to share his profits to some extent by paying higher wages to his employees, but because of the relative scarcity of labor may have to do so. These conditions are for the most part temporary, and the situation has nothing in common with that of a shrinkage of employment coupled with a normal labor supply. Under such conditions the wage of labor would naturally fall instead of rising.

We are personally convinced that the growing scarcity of raw material, if the products are not to reach prohibitive prices, must result to the disadvantage of the labor engaged in the industry. No exhaustion of a basic natural resource has ever yet benefited labor in the long run. It is conceivable, on the other hand, that with cheap raw material and increasing prices for the product, the share of labor may be larger than before, instead of smaller.

9. *"Idleness of some of the cut-over timberlands is the temporary result to be expected of clearing the forests from lands upon which maintenance of permanent forest growth would be poor public economy, because involving relatively wasteful use of the soil."*

Temporary idleness of cut-over lands which within a short time will be absorbed by agriculture or other use may be economically justifiable. Idleness, even temporary, and protracted idleness of potential agricultural land which might produce another timber crop before

being used for agriculture, is economic waste. If such idleness is accompanied, as in the case of cut-over lands, by accumulation of vast areas in the hands of a few people, in face of rising prices for food and other raw materials, it is a social menace. At the bottom of the present world unrest is land monopoly. The breaking up of large landed estates into small units for use by tillers of the soil and actual settlers is the cry of the people of Europe today. Poland, Czecho-Slovakia, Jugo-Slavia, Roumania, Hungary, Russia, and even England, are already in the midst of such land reforms. Is the lumber industry, which by its present methods converts productive land into idle land and leaves it concentrated in large areas held by a few owners, willing to assume the responsibility of adding to the unrest in this country?

10. *"Idleness of other of the cut-over timber lands is the inevitable result of clearing the forest from lands upon which regrowing of a new forest would be poor private economy."*

There may be lands now owned by lumbermen upon which private owners cannot profitably grow timber. If public welfare, as Dr. Compton suggests, requires that these lands be forested, one may be permitted to wonder why private operators should ever be permitted to clear them in the first place. Even if cutting of merchantable timber on such lands is permissible, it should not be construed as license to devastate. For decades now, foresters have insisted that "greater enlightenment of some owners of cut-over timber lands would induce them, out of plain self-interest to foster on their own now idle lands reforestation by natural replacement, encouraged by protection against fire and ravage." It is to be hoped that the *enlightenment* may come before it is too late.

11. *"The owner of private property in timberlands, legally acquired, is under no different or greater public obligation permanently to use his land to grow timber than the obligation of the owner of agricultural land to use his land to grow farm crops if the growing of such crops is unprofitable."*

Dr. Compton confuses the public obligation of an individual with that of an economic group or class. An individual farmer or an individual timber owner of course is under no public obligation to remain permanently in the business of growing timber or crops if it is against his personal interests. As long, however, as the farmer

or the timberland owner retains his property, he is under public obligation, if not legal, not to reduce it to waste land. As classes, however, farmers as well as timberland owners are under public obligation to continue producing crops. The farmers, indeed, have been doing this for centuries, while the timber owners have been merely harvesting wild crops upon the production of which they spent no effort. If in individual cases timber can be grown on the land only at a financial loss, one of two things must be true: either the land can be put to some other use which does not involve a loss, and should therefore not be considered potential forest land, or it cannot be owned by the individual except at a loss, in which case it is difficult to see why the owner should want to keep it. Moreover, even the individual farmer is not entirely free to handle his crops and orchards as he imagines his own self-interest would dictate. In many States there are regulations requiring spraying of fruit trees, removal of host-plants carrying diseases, removal of noxious weeds, regulating the handling of live stock in cases of outbreak of contagious diseases, and so on. It is true that some methods of farming result in gullying and consequent abandonment of land. In most cases, however, such treatment is due rather to ignorance of proper methods than to wilful abuse of the land. Where such devastation of agricultural land cannot be prevented by education, which is now amply provided by the State and Federal Governments, and where the damage done by erosion is on a sufficiently large scale to cause public concern, then it comes in the same category with devastation of timber lands, and must come under State police regulations or Government control.

Our taking of the American continent from the Indians was justified on the ground that we would make use of the land which they were allowing to lie idle. If now the farm owners of the United States should decide that there is not enough profit in growing farm crops, but should undertake merely to harvest whatever crops might grow wild on the land, and should at the same time use their land in such a way that not even wild crops could be harvested for one or more generations thereafter, how long would it be before their public obligation to farm the land was made a legal obligation, or the lands confiscated? Yet the timberland owners, as a class, have taken a course very similar to this—not because they could not grow timber crops at a profit, but because they could make a greater profit by harvesting wild crops in such a way as to destroy the possibility of even wild future crops on much of the land.

12. *"The legal obligation upon the owner of property—an obligation that is universal and should be enforced—so to use it as to do no damage to another's property and to do no public injury does not include an additional obligation to make a specific positive use of it which, although intended to benefit the public at large, involves a loss to the individual himself."*

It all evidently depends on what we are to understand by the expression "public injury." To cut over lands which are chiefly valuable for timber production, or which for reasons of public interest should be covered with forest growth, in such a way that they will not quickly restock by natural means, and failure to reforest them by planting or otherwise, *is* to do a public injury. The decision of the Supreme Court (of the State of Maine) is very explicit on this matter:

"It is recognized that the State as a quasi-sovereign and representative of the interests of the public has a standing in court to protect the atmosphere, the water, and the forests within its territory, irrespective of the assent or dissent of the private owners of the land most intimately concerned. . . . . We are of the opinion further that the constitutional power of the State to insist that its natural advanages shall remain unimpaired by its citizens is not dependent upon any nice estimate of the extent or present use or speculation as to future needs."

Dr. Compton is still harking back to the times of Adam Smith, when unrestrained growth of industry and total wealth of a nation was considered tantamount to public welfare. After a century of unrestrained industrialism very few economists will now subscribe to this view. Public welfare, increase in human progress and happiness, can be secured only by subordinating the self-interest of a few to the common good of the many. If the self-interest of the timber owners of this country, although spelling greater immediate prosperity to the individuals means devastation of land, decreased opportunities for employment and decrease in the production of essential raw material, then in the interest of public welfare, such practice must be stopped, whether it involves a loss to the private owner or not.

13. *"If the public is interested in any use of timber lands or of cut-over lands different from that which the enlightened self-interest of the owner may dictate, the public which is the beneficiary should pay the additional cost."*

We seriously doubt whether the self-interest of the timber owners may generally be described as "enlightened." If it were, the lumber

industry would hardly have found itself in the state of economic embarrassment under which it has admitted that it labored during the past two decades. The chief reason for this embarrassment is that the lumber industry ignores the rudimentary principles of sound forest finance. Really enlightened self-interest would dictate the handling of timber property not as a mine, but as a permanent investment in a renewable resource, so that enormous holdings of standing timber would be assets instead of heavy burdens.

Hardly another great industry was so near general bankruptcy as was the lumber industry, until it was granted a temporary reprieve due to conditions arising from the war. Dr. Compton implies that the individuals who have invested in the business can be saved only by allowing unrestrained destructive exploitation of the basic natural resource upon which the existence of the industry itself depends and which supplies material essential to the public welfare. He also asserts that to restrict this destructive exploitation will violate the Constitution of the United States, whose chief purpose, he says, is to preserve and protect the rights of private property. Even if they can be saved only by freeing them from restraint, which we do not admit, to do so will far more seriously violate the intent of the Constitution than to insure the present and future welfare of the public by requiring careful use of the resource, even at the expense of a few individuals. If Mr. Compton is entirely familiar with the Constitution he knows that its purpose, as expressed in the Preamble, includes furthering the general welfare of the nation and all its people, but does not mention the preservation of private property, and that this is later provided for in the fifth and fourteenth amendments, as a means to promote the expressed purposes of the instrument. As between the welfare of the whole country and the pocketbooks of a few individual property owners, we prefer the former.

14. *"The maintenance in idleness of cut-over land is declared to be wasteful. The larger truth would seem to be that it is wasteful to maintain cut-over land in such state of idleness as does not furnish safeguard against fire and ravage which destroys the natural reproduction of desirable species."*

After having categorically stated, in several of his previous arguments, that it would be poor public economy, wasteful use of the soil and against the interest of private economy to put to productive use cut-over timber lands, Dr. Compton in his concluding point hedg-

ingly admits that it *is wasteful* to maintain cut-over lands in idleness. Evidently what he has in mind is that as long as the idleness of these lands is not laid at the door of their owners he has no objection to having the public protect privately-owned cut-over lands from fire and devastation. This admission weakens Dr. Compton's entire position because if it is wasteful to keep cut-over lands in such condition that natural reproduction of desirable species is destroyed, then it is even more wasteful, unless the reproduction is to be supplied by human effort, to cut the land over in the first place in such a way that natural reproduction of desirable species is made impossible. It is a pleasing dream, but unfortunately not true, that "nature, unaided by human effort, would, if given the opportunity, itself solve much if not most of the problem of providing forests for distant future use." Protection against "fire and ravage" involves human effort. Moreover, there is no more reason to believe that nature alone can supply the needs for wood of an increasing population and industry than to believe that nature alone could supply our future needs for food. Perhaps all or most of the lands producing farm crops today would produce crops of grass or some kind of food plants without human effort, and the persons who harvested these crops could possibly make a large per cent of profit on the capital invested. The man who farms his land has tied up a much larger investment in labor and capital, and probably in most cases makes a smaller per cent on his investment than if he were merely mowing wild lands, but he makes more money altogether and contributes far more to the public welfare. We personally believe that most efficient fire protection will come only when the mature forests themselves shall begin to be cut in such a way as to secure natural reproduction. We cannot expect a high degree of efficiency, involving large expenditures of money, on property which is to be laid waste. Inefficiency in the cutting of the timber without provision for its future replacement tends to be followed by inefficient protection of the property thus treated. Furthermore, when a forest property is handled as a permanent resource, which involves construction of permanent roads, proper distribution of cuttings, utilization of the tops, and disposal of brush, it provides at the same time a most efficient basis for fire protection. The property then can be so developed that it becomes less subject to fire danger. In order to lessen the danger from fire in a city it is not enough to have an efficient fire department. There must be proper building regulations, proper regulations to prevent the

accumulation of inflammable rubbish, a proper planning and laying out of streets. With the most efficient of fire departments, a crowded city built of inflammable shacks is a poor fire risk. Fire protection alone, although it is very essential, will not solve the problem of our cut-over lands or of the future needs of the country for wood. Even on the National Forests, where the timber is afforded a higher degree of protection against fire than may be expected for the country as a whole in the very near future, the system fails in exceptional seasons like the one just past, because of the undeveloped condition of the forest itself.

We have attempted to answer specifically each of Dr. Compton's points. As a matter of fact, his entire argument, stripped of its pseudo-economic sophistries, simmers down to two points:

1. The past and present treatment of the forests by the lumber industry is fully compatible with the public welfare; even the admitted large stretches of idle land, the virtual disappearance of many of our most important kinds of timber, the decline in lumber and wood-using industries, are not only not evils, but actually promote the national welfare.

2. The lumber industry, although it retains ownership of the bulk of our best forest land, is under no moral, social, or legal obligation to so handle the forests of the country as to provide for the future needs of the people unless such treatment can be shown to be highly profitable to the individual owner.

If this represents the true opinion of the leaders of the lumber industry, we are willing to join issues with them and go to the people for a verdict.

X.

CLIMATE AND FOREST FIRES IN NORTHERN CALIFORNIA

By S. B. Show,

Forest Examiner, U. S. Forest Service

In a broad way, the general relation between climate and fire is obvious. The annual recurrence of the fire season is accepted as a matter of course; but we do not yet know when, in a specified locality, the potential fire season begins, or even when it ends, nor the weather conditions during the fire season which create emergency periods or periods of no danger. Neither is there definite information regarding the relative importance of wind, slope, temperature, or humidity in determining the rate of spread.

The possibility of fires starting and the rate at which they will spread are largely dependent on the climate, using the term in a broad sense; but any study of the relation of climate to fires, to have much value, must analyze the effect of each of the several components before attempting to determine the effect of climate as a unit.

This paper is but a bare start, and can claim to present only a few definite figures of perhaps merely local value to illustrate certain specific relationships between climatic factors and forest fires.

The data used were obtained at the Feather River Experiment Station in 1915, 1916, and 1917, in connection with a study of the rate of spread of fires as controlled by physical factors.

IGNITION POINT

Logically, the first point to be considered is the ignition point of litter, or that percentage of moisture, based on dry weight, at which the ground cover can catch fire and spread.

The litter of the timber—composed of needles, small twigs, bits of bark, dead weeds, and grass—holds against gravity, when saturated with moisture, from 60 to 110 per cent of its dry weight. Capacity seems to depend on the age, degree of decomposition, and relative proportions of the various substances. Table 1 shows the results of a series of tests on the saturation point.

TABLE 1

[Weights are all in grammes.]

Sample number.	Air-dry weight.	Saturated weight.	Moisture loss.	Percentage of mosture.
1	73.650	134.300	60.650	82.
2	83.950	148.900	64.950	77.
3	70.000	114.800	44.800	64.
4	81.700	116.350	34.650	43.
5	70.960	154.660	73.700	104.
6	74.500	156.760	82.260	110.5
7	86.620	174.315	87.695	101.
8	82.450	157.450	75.000	91.
Average	77.960	144.695	66.735	85.7

The ignition point was determined experimentally by mounting two-thirds of a square foot of undisturbed litter on sheets of tin, air-drying the samples to a constant weight, saturating, and drying in shade until the litter burned freely. The litter was dried slowly so that the moisture loss should be uniform throughout the sample, and weight determinations were made before each test for burning, since, of course, after burning it would be impossible to obtain the moisture content. The data are shown in the table:

TABLE 2

Sample number.	Air-dry weight.	Weight when burned.	Weight of moisture.	Percentage of moisture.	Remarks.
1	236.370	268.288	30.918	13.5	Failed to burn.
2	296.000	319.099	23.088	7.8	Burned
3	343.550	371.726	28.176	8.2	Burned
4	241.670	263.781	21.511	8.9	Failed to burn.

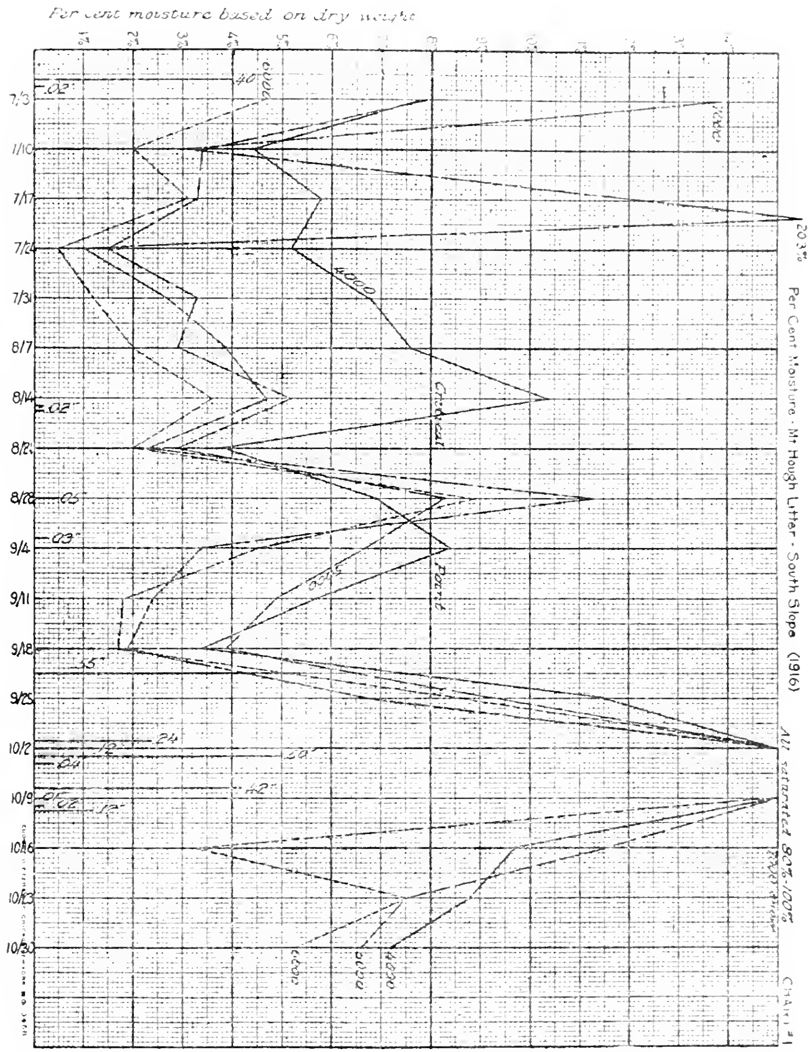
It is clear that about 8 per cent of moisture is the critical point.

Tests made at the Priest River Experiment Station also show that 8 per cent, based on oven-dry weight, is the critical point in that region. It has been found by a series of tests here that the air-dry weight of litter at 80° to 90° Fahrenheit, and 20 per cent relative humidity is only 1 to 2 per cent greater than the oven-dry weight.

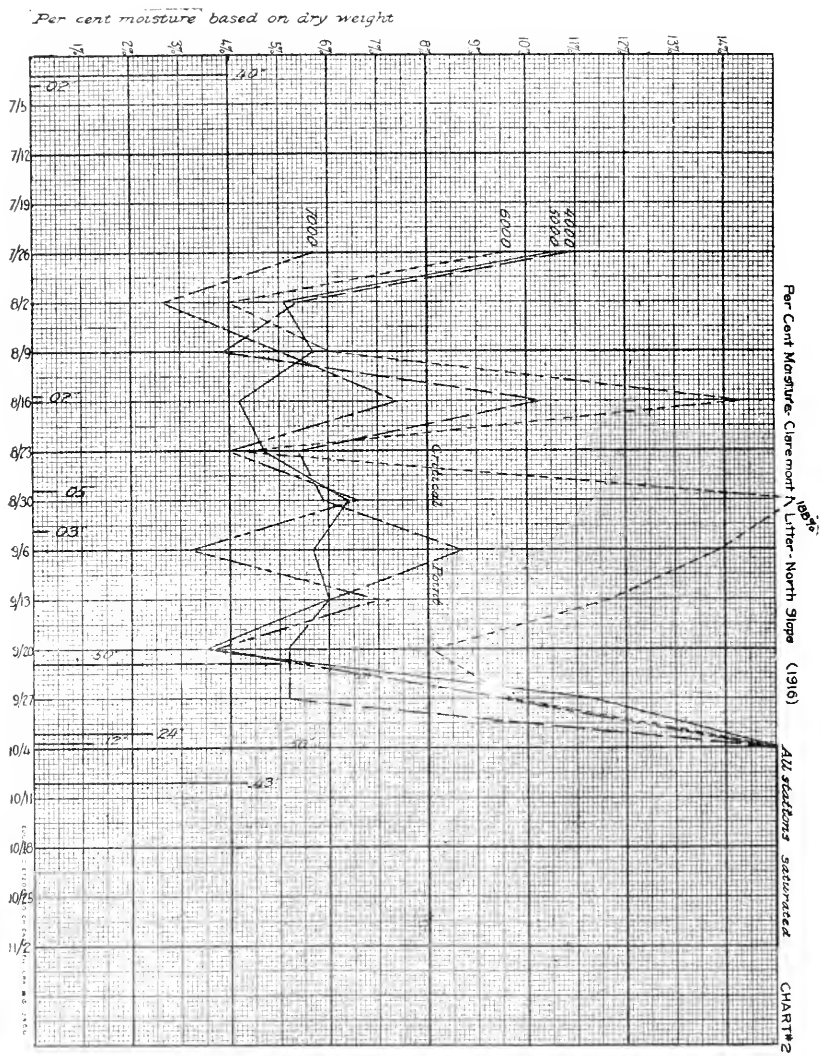
The potential fire season then begins as soon as the litter contains 8 per cent or less of moisture, or strictly speaking, when the top layers contain that amount, since fire can spread if only the top half-inch or so of a 3-inch layer is dry.

SEASONAL CHANGES IN MOISTURE CONTENT OF LITTER

The moisture content of litter during the fire season, 1916, at 4,000, 5,000, 6,000, and 7,000 feet elevations on north and south slopes near



the station is shown in charts 1 and 2. Samples were taken at intervals of one week, and the percentage of moisture is based on oven-dry weight. Precipitation recorded during the period at the experiment station is shown on each chart. It is to be noted that local storms occurred at the higher elevations. Table 3 shows the number of days in each week and the period during which the litter at each station was above (+) and below (—) the critical point of 8 per cent. Perhaps



the most interesting feature of the charts is the rapid drying out of the litter to the danger point on Mt. Hough (south slope) after the storms of early October, while on Claremont (north slope) the litter remained saturated. This may be considered in connection with the close of the fire season.

RATE OF MOISTURE LOSS FROM LITTER

Litter loses moisture at a surprisingly rapid rate when exposed to sun and wind. Chart 3 shows the result of a series of tests made in June on samples of litter, first saturated with moisture, then exposed to sun and wind and weighed at intervals at first of one-half hour and later of

Table 3

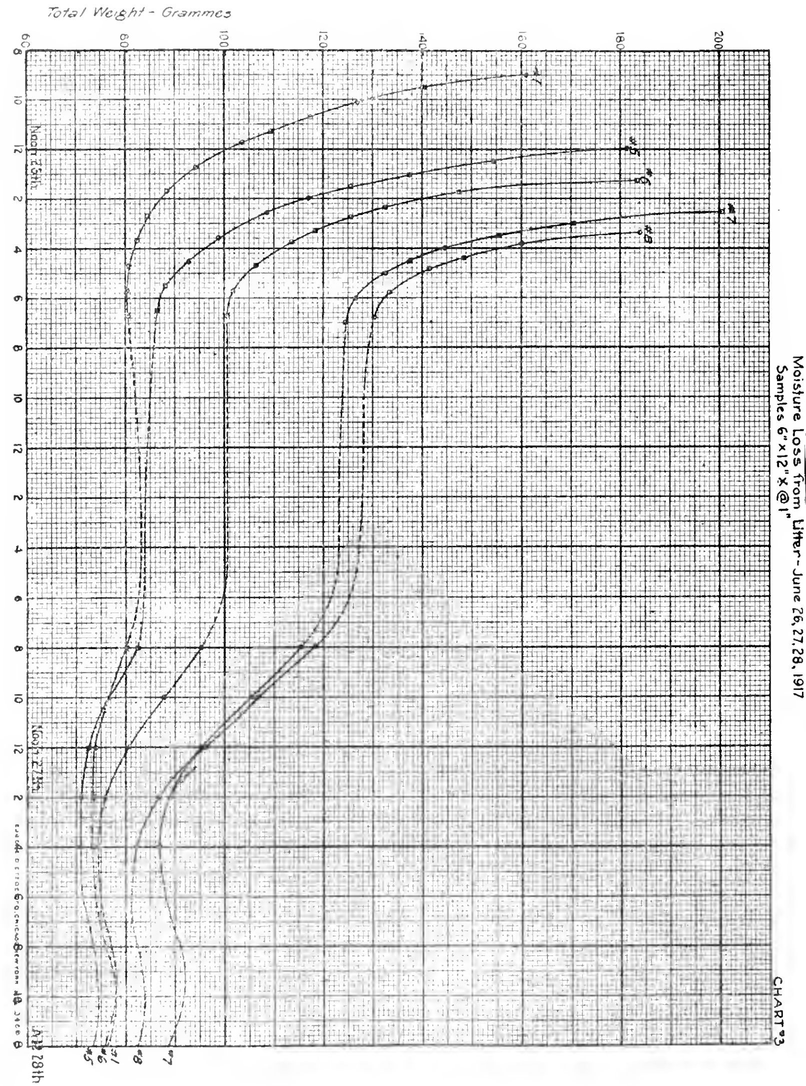
	Hough								Claremont							
Week ending	4,000		5,000		6,000		7,000		4,000		5,000		6,000		7,000	
	+	—	+	—	+	—	+	—	+	—	+	—	+	—	+	—
7-10	....	7	....	7	....	7	3½	3½	....	....	....	....	....	....	....	....
7-17	....	7	....	7	....	7	4	3	7	....	7	....	7	....	7	....
7-24	....	7	....	7	....	7	4	3	7	....	7	....	7	....	7	....
7-31	....	7	....	7	....	7	....	7	3½	3½	3½	3½	2	5	....	7
8- 7	....	7	....	7	....	7	....	7	....	7	....	7	....	7	....	7
8-14	6	1	....	7	....	7	....	7	....	7	4	3	3	4	....	7
8-21	3	4	....	7	....	7	....	7	....	7	3	4	4	3	....	7
8-28	....	7	½	6½	1	6	4	3	....	7	....	7	3	4	....	7
9- 4	2	5	1	6	1	6	3	4	....	7	2	5	7	....	....	7
9-11	1	6	....	7	....	7	....	7	....	7	3	4	7	....	....	7
9-18	....	7	....	7	....	7	....	7	....	7	....	7	7	....	....	7
9-25	4	3	4	3	1	6	....	7	4	3	....	7	7	....	4	3
10- 2	7	....	7	....	7	....	6	1	7	....	7	....	7	....	7	....
10- 9	7	....	7	....	7	....	7	....	7	....	7	....	7	....	7	....
10-16	7	....	7	....	4	3	7	....	7	....	7	....	7	....	7	....
10-23	7	....	6	1	....	7	7	....	7	....	7	....	7	....	7	....
10-30	3½	3½	....	7	....	7	7	....	7	....	7	....	7	....	7	....
Totals	47½	71½	32½	86½	21	98	52½	66½	56½	55½	64½	47½	89	23	53	59

Summary

	Moisture Content			
	Above 8 per cent		Below 8 per cent	
	Days	Per cent	Days	Per cent
Average, south slope.............	38.4	32.3	80.6	67.7
Average, north slope..............	65.7	58.7	46.3	41.3

For the period, litter was above danger point one-third of the time on the south slope, three-fifths of the time on the north slope.

one hour until a constant air-dry weight was reached. The samples, each 6 inches by 12 inches and from 1 to 1½ inches thick, were started at intervals of one hour, beginning at 9 a. m. It is seen that in all cases the moisture loss is extremely rapid at first. As a matter of fact, the very top layer of each sample was dry enough to burn within one hour after exposure, as was proved by test, and later losses were from the lower layer, protected from excessively rapid dessication. Note that the earlier samples had practically ceased to lose moisture by 6



p. m. the first day, though still exposed to direct sunlight; that they gained weight overnight, and had a comparatively small moisture loss the second day, reaching air-dry weight about 2 p. m. The later samples, Nos. 5 to 8, lost less moisture the first day and continued to lose during the night, and became air-dry late the second day. All samples gained in weight during the second night. It is perhaps a fair

deduction that during the summer the effect of any rain may be entirely lost in from one to two days, when the litter is exposed to direct sunlight, and there is even a slight circulation of air. The rate of moisture loss is lower and the period for drying out is longer when the litter is in the shade, with air, temperature, humidity, and wind movement the same as in the sun.

It is probably true that the rate of drying out of small samples is somewhat more rapid than in nature, but the available evidence certainly indicates that even a soaking rain, which completely saturates the litter, may lose its effect in a very short time, and that an attitude of complacency and a let-down in protection alertness are not justified during the fire season. A study of the moisture relations on Mt. Hough also indicates that the end of the fire season comes when the content of the litter is above the ignition point, and not when a good rain early in October apparently ends the danger for the year. Certainly the records show that fires can and do occur after the fall rains, and after the protective organizations have been disbanded. Such fires frequently are larger than those during the recognized fire season, as, for example, on the Shasta National Forest in 1911 and 1916.

An interesting example of rapid dessication of litter occurred in September, 1915. On September 13, a rain of 0.14 inch fell between 2 p. m. and 6 p. m. During the rain, brush piles were burned on the grounds of the Feather River Experiment Station, and in no case did the fire spread. The morning of the 14th was cloudy until 10 a. m., after which the sun shone, and more brush was burned between 8 and 10 a. m. without the fire spreading. On the afternoon of September 14 a series of ten fires was set on pine needles, each fire being allowed to burn 15 minutes. In every case the fire spread freely and it is apparent that the effects of the rain were lost in a very few hours.

PROPERTIES OF AIR-DRY LITTER

Air-dry litter is markedly deliquescent, that is, it takes up moisture from the air, independently of precipitation. Chart 3 shows this, and it may be said that even during the hot summer season (June to August) the litter takes up from 5 to 6 per cent of its air-dry weight every night. This explains to a very large extent the well-known fact that fires burn more slowly by night than by day, though other factors —wind movement and temperature—also play a part.

In June, the litter begins to take up moisture at about 5 p. m., and starts to lose it at about 6 a. m. Later, or earlier in the season, this period is of course correspondingly longer.

SEASONAL MARCH OF EVAPORATION

Chart 4 shows the average evaporation rate for each month of the fire season on the north and south slopes (elevation, 3,500 feet), measured by the U. S. Weather Bureau evaporation pan and corrected for precipitation. The rate on the north slope is uniformly about 25 per cent lower than that on the south slope or flat (which are nearly equal); the peak is reached in July; the rate holds up fairly well in August, and then drops rapidly. The evaporating power of the air in July is 2⅛ times as great as in April, 1⅔ times as great as in May, 1¼ times as great as in June, and 1½ times as great as in September. Evaporation as a factor is chiefly important in reducing the moisture content of the litter to the danger point after a rain.

SEASONAL VARIATIONS IN WIND VELOCITY

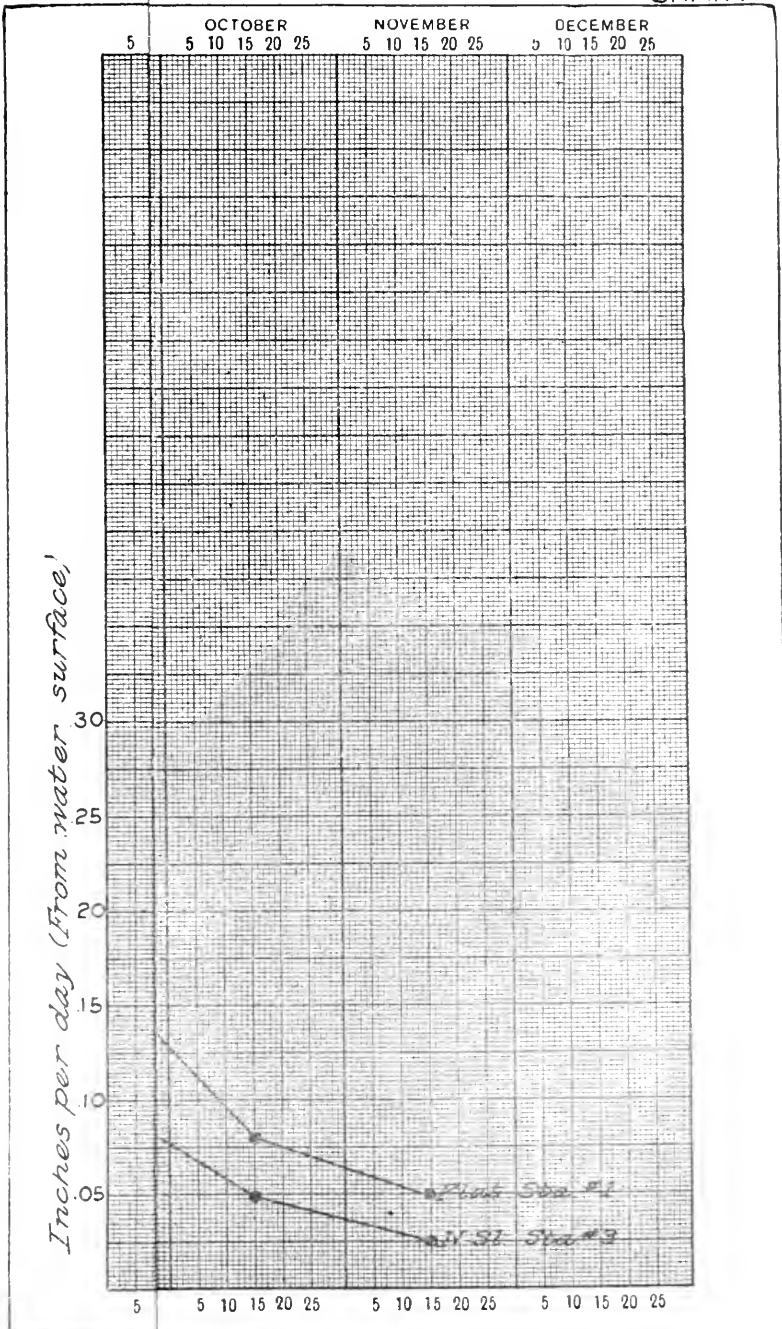
Chart 5 shows the daily wind movement for each month at the experiment station, based on four years' average. The months, April to September, inclusive, or roughly, the fire season, show values above the average, while the others are below. Being based on one station only, the figures, of course, cannot be applied generally, but serve, perhaps, as a fair indication of the general trend of wind movement in the Sierras. Values vary for individual years and months, but the general tendency of wind velocity to follow the same annual course as air temperatures is well marked.

DAILY VARIATIONS OF WIND VELOCITY

During the period, June to November, 1916, an automatic-recording wind register was maintained on Mt. Hough at the lookout station. Chart 6 shows the average wind movement for different hours of the day for this station, based on the entire period of observation. The fluctuations are very striking; the maximum velocity is reached about 2 p. m., or the hottest part of the day, and the minimum early in the morning. The general tendency already noted, for wind velocity to follow temperature, is here very marked. It is perhaps unnecessary to say that individual days show an entirely different set of values, especially when wind direction is changing, but the data are sufficient to warrant the statement that wind velocity may be expected to be highest during the hottest part of the day and lowest at night.

This record was made at an elevation of something over 7,000 feet, and presumably represents the so-called "master-winds," or the main

CHART #4



EUGENE DIETZGEN CO., N. Y. NO. 354

Evaporating Power of Air-Average of Two Years (1915-1916)
FEATHER RIVER EXPERIMENT STATION

CHART #4

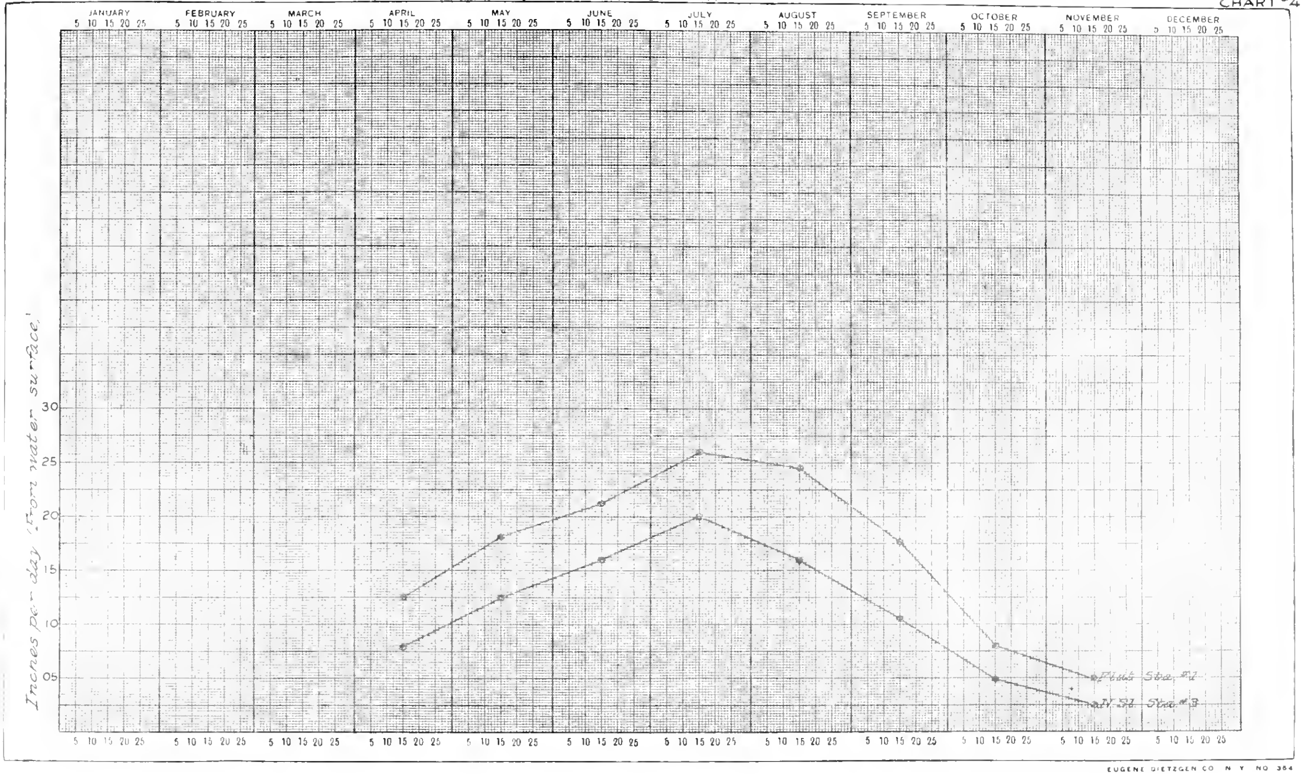
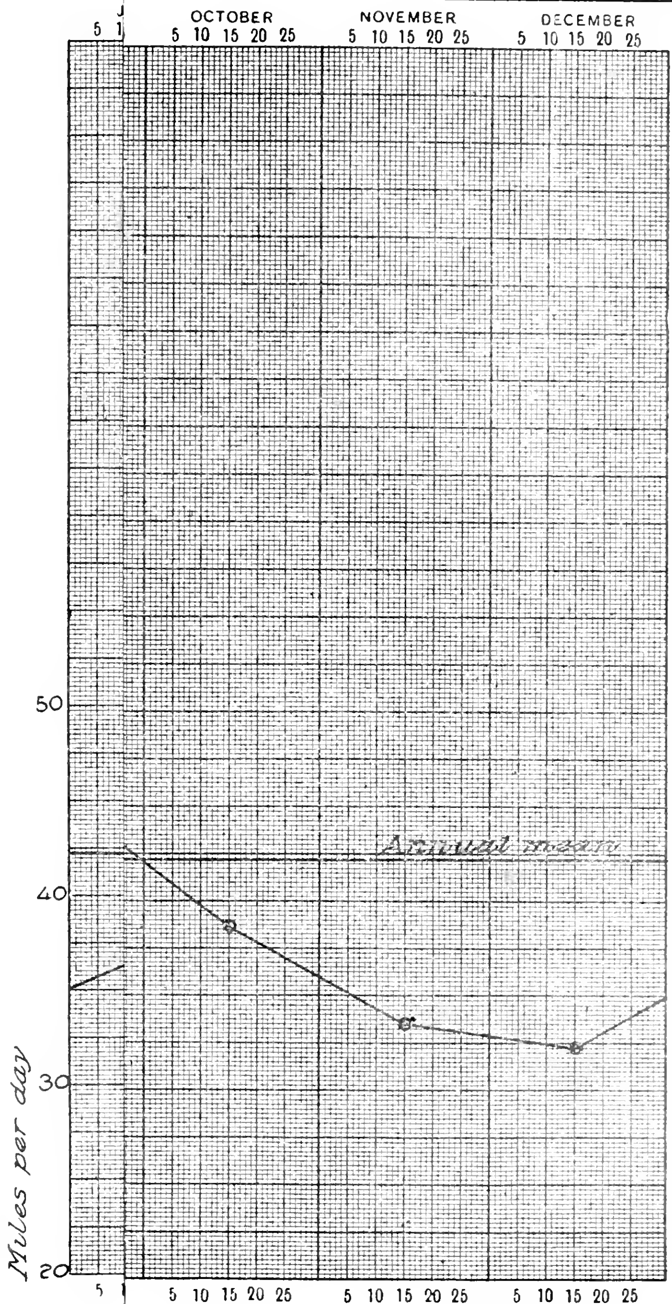
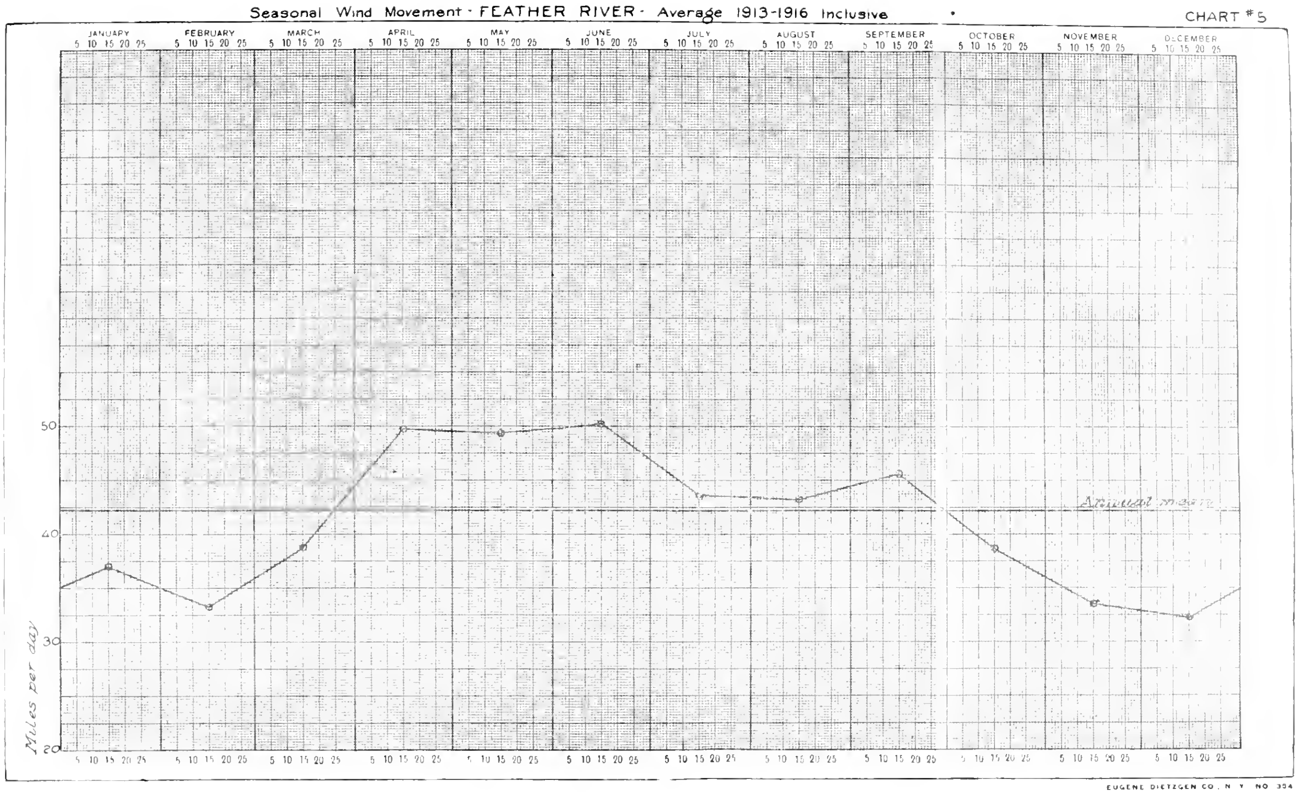
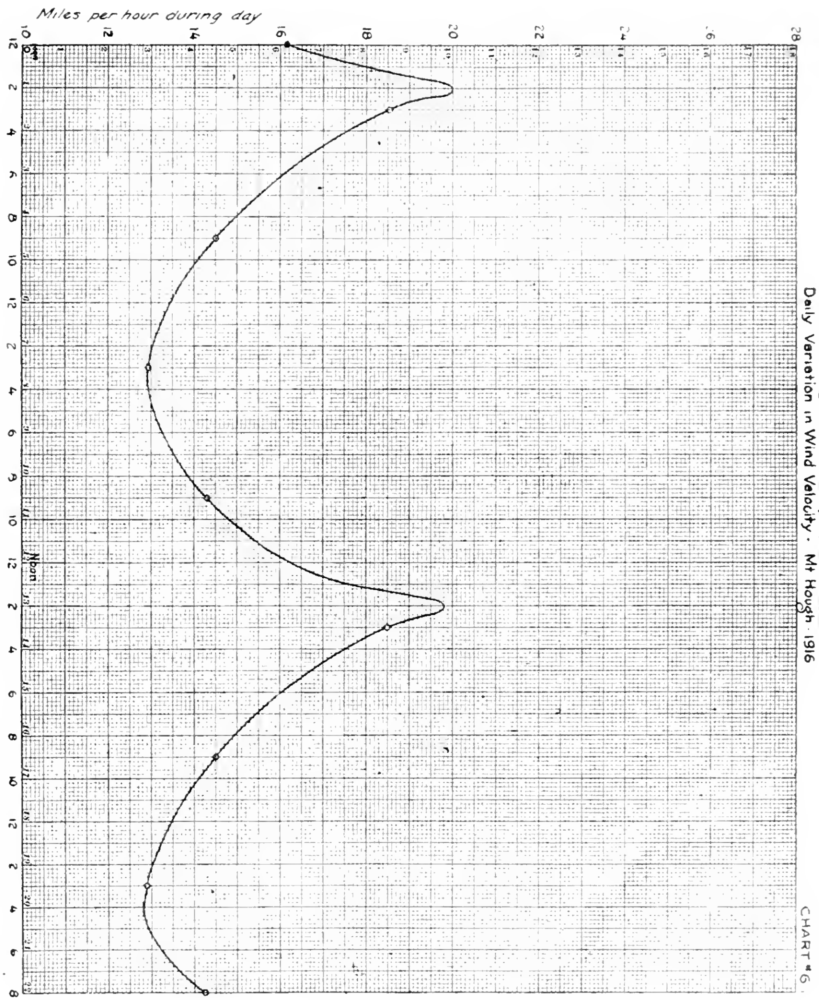


CHART #5



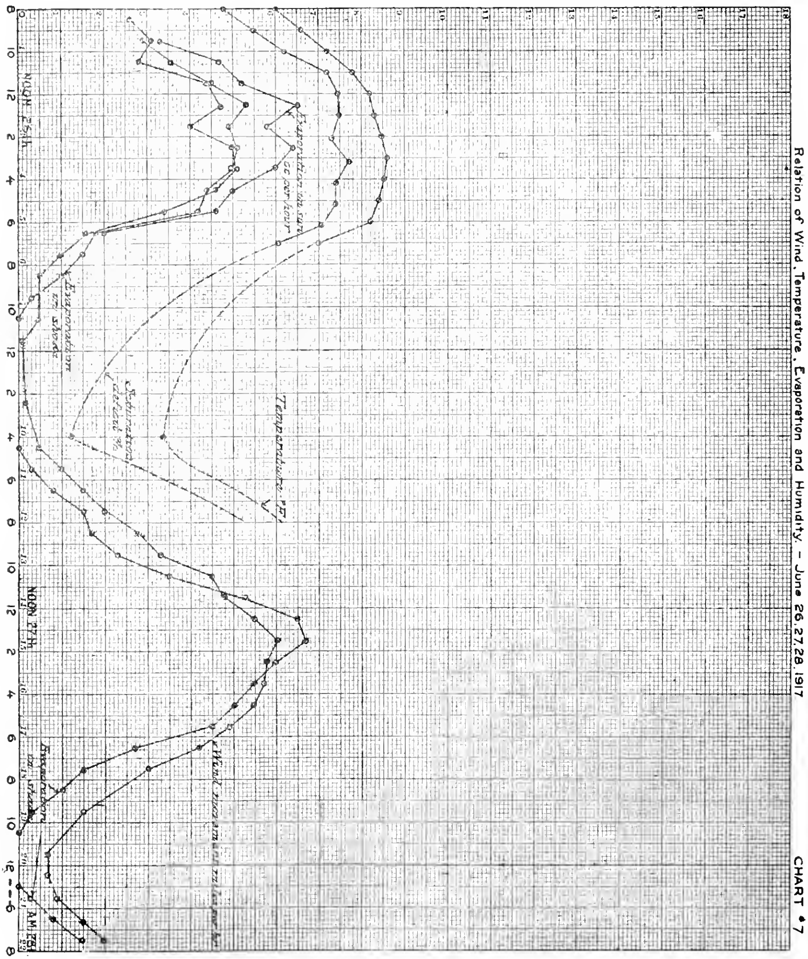
EUGENE DIETZGEN CO., N. Y., NO. 354


Seasonal Wind Movement - FEATHER RIVER - Average 1913-1916 Inclusive
CHART #5
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
5 10 15 20 25
50
40
30
20
Miles per day
Annual mean
EUGENE DIETZGEN CO., N. Y. NO. 354



air currents. The high velocity, averaging 15.8 miles per hour, is typical of the higher elevations throughout the Sierras and is in decided contrast to the average of four miles per hour at the Feather River Station, which is 3,500 feet lower and only about 6 miles distant by air line.

A short record at the experiment station in June, 1917, shown on Chart 7, is also of considerable interest. Temperature, saturation deficit of the air, wind velocity, and evaporation in sun and in shade, are all found to follow the same course, exhibiting maxima at about



3 p. m. and minima at about 4 a. m. These days were typical clear, summer days, and the record, though short, is of considerable significance.

RATE OF SPREAD OF FIRES

Three possible measures of rate of spread may be adopted: 1, Linear distance from start; 2, Area burned; 3, Perimeter.

The first is of little value; the second may be used, since damage varies as area; but for our present purpose the third is most signifi-

cant. The suppression energy necessary to corral a fire varies directly as the perimeter, and for that reason it will be used in this study as the criterion of rate of spread.

On level land, with no wind, and with uniform cover, a fire spreads in a circle and the perimeter varies directly with linear distance traveled. Wind and slope will, however, modify the shape of a fire, so that it tends to become longer in one axis than the other, though still retaining a generally oval shape. In other words, for a given geometrical figure, equal increments of time give equal increments of perimeter. In the actual experimental fires it is found that, with slow rate of spread, the perimeter time relation is approximately a straight line up to a period of two hours; with more rapid spread, under wind, the increments of perimeter increase from period to period and, instead of a simple arithmetical progression, perimeter on time tends toward a geometrical series. Two independent factors are active in the case of rapid spread: First, the ratio between linear spread and perimeter (which is, of course, 3.14 for a circle) tends to increase, so that perimeter increases more rapidly than distance traveled. Second, the release of a large amount of heat, in a short period, results in convectional currents of air, which increase the wind velocity and hence the rate of spread; or, to put it more simply, a fire creates its own draft. The extent of this increase is difficult to measure instrumentally. In one case, in which the wind velocity 300 feet from the fire was 4.4 miles per hour, the velocity at the front of the fire was 6.2, or roughly 40 per cent higher.

Without many more data than are now available, it is impossible to formulate any definite law of the relation of perimeter to elapsed time. Table 4 shows, for 23 experimental fires, the average perimeter increases, by 5-minute intervals.

TABLE 4

Periods after start.	Perimeter linear feet.	Perimeter increment.
1	33	33
2	66	33
3	106	40
4	188	82
5	302	114
6	460	158
Average	...	76

Slowly spreading fires, on the other hand, exhibit a straight-line relation, as Table 5 shows. The intervals of elapsed time are 15 minutes.

TABLE 5

Periods after start.	Perimeter linear feet.	Perimeter increments.
1	104	104
2	240	136
3	360	120
4	460	100
5	588	128
6	744	156
7	792	48
Average	...	113

It is seen that increases in perimeter are very nearly constant for all periods, except the last.

INFLUENCE OF WIND VELOCITY ON RATE OF SPREAD

No discussion is necessary to prove that wind has a profound influence on rate of spread of forest fires; the statement is sufficient. But to deduce a general law from experimental data is a very difficult problem, for wind is only one of several factors which combine to determine the rate of spread, and its isolation and evaluation is not easily accomplished. In the 33 experimental fires, however, enough measurements were secured so that at least some tentative conclusions can be offered regarding the effect of this factor.

Three series of fires, 8, 10, and 15 in number, were available. For each series the same criterion of rate of spread, namely, perimeter 15 minutes after the start, was used. The other factors—slope, temperature, relative humidity, and elevation—were averaged for each series and were found to agree very closely, especially for Series I and III. The average figures only are shown in Table 6.

TABLE 6

Series	Slope	Relative humidity	Average temperature	No. of fires
I	15°	26	82	8
II	14°	30	72	10
III	12°	22	78	15
Average	14	26	77.3	

Series I and III were burned during periods of the warm, dry, early fall weather, long enough after rains so that the litter was air dry.

Series II, on the other hand, was burned on the day after a rain, as soon as the litter was dry enough to ignite.

For each series the fires having the same wind velocity were then averaged. Thus, velocities of 1.6 to 2.5 miles per hour were thrown together, 2.6 to 3.5 miles, etc., and the perimeter measurements were also averaged. After this had been done, it was found that the average values in Series I and III were practically identical, but the size of the perimeter for a given wind velocity was much lower in Series II than in the other two, due, of course, to greater moisture content of the litter.

In order to compare all fires by the same standard, the basic rate of spread—that at 0.0 miles wind velocity—was taken as 100, and for each series the values at different velocities were referenced to this base. The values thus derived give, of course, not actual perimeters, but relative indices.

Table 7 shows the final line-up of the average derived index figures.

TABLE 7

1	2	3	4	5	6	7
Wind velocity, miles per hour	Relative length of perimeter			Average value, minus 100	V^2	Column 5 divided by column 6
	Series I and II	Series II	Average			
0	100	100	100	0	0	
1	115	148	132	32	1	32
2	200	240	220	120	4	30
3	450	320	385	285	9	32
4	800	400	600	500	16	32
5	1140	490	815	715	25	29

It will be seen that there are considerable differences in the values derived for the different series, and, indeed, there is no intention of claiming that this preliminary study is the final word on the subject. An examination of the last three columns is, however, very instructive in showing a possible mathematical law, which expresses rate of spread as governed by wind velocity. Column 5 gives the average relative perimeter for wind velocities of 1 to 5 miles an hour; column 6, the square of wind velocity; and the last column, the index figures secured by dividing column 5 by column 6. The last figures are practically constant for the velocities tested and for the data. We may say that rate of spread in perimeter varies as the square of wind velocity. It is

interesting and instructive to remember that wind pressure based on velocity also varies as the square of the velocity.

It must be perfectly evident that the data here used are insufficient to justify the definite and final statement that the above law actually expresses the relation. Considering, however, the care with which the observations were made and the rather close agreement with the formula of the empirically derived values, the law may at least serve as a working hypothesis, against which future data may well be checked.

With the data presented, it may be of interest to compute the probable relative rates of spread of fires at different hours of the day, as governed by wind velocity.

TABLE 8

Hour	Velocity	Relative rate of spread
12 Mt.	13.5	108
3 A. M.	13.0	100
6 A. M.	13.2	103
9 A. M.	14.3	120
12 M.	16.2	151
3 P. M.	18.5	202
6 P. M.	16.2	151
9 P. M.	14.5	124

Velocity data from Chart 6.

Thus, the lower temperature and higher humidity, both of the air and of the litter, being left out of consideration, fires, as influenced by wind, are likely to spread only half as fast at night as during the early afternoon.

SUMMARY

This preliminary study shows:

1. Litter is capable of holding its own weight of moisture, but a layer of litter from 1 to 1½ inches deep can, under normal conditions of summer weather, be reduced from the saturation point to air dry in from one to two days.

2. Litter with over 8 per cent of moisture will not burn, and this is therefore the critical point.

3. During the fire season great fluctuations in moisture content occur on different exposures and at different elevations. On a north slope the moisture content may be above the danger point for three-fifths of the season as compared with one-third on a south slope during the same period.

4. In fire protection, clear weather in late fall may result in the rapid drying out of litter, even at high elevations and after it has been saturated by over an inch of rain.

5. Air-dry litter has the property of taking up moisture from the air, chiefly at night, to the extent of 5 to 6 per cent of its own weight.

6. A study of the factors influencing the dryness of litter, namely, evaporation, mind movement, relative humidity, and temperature, shows that they all have the same seasonal and diurnal maxima and minima.

7. Rate of spread of fires is best measured by size of perimeter, rather than by linear distance traveled or by area covered.

8. For slowly spreading fires, size of perimeter based on elapsed time is an arithmetical progression, while with more rapid spread it tends to become a geometrical progression. This is due, in part, to changes in the shape of fast spreading fires and, in part, to the creation of a draft by the fire itself.

9. Rate of spread, as governed by wind velocity, may be stated to vary as the square of the velocity.

REVIEWS

Firewoods: Their Production and Fuel Values. By A. D. Webster, T. Fisher Unwin, Ltd. London, 1919. Pp. 95, illustrated.

The principal reason for writing this book was "that the question of firewood production and utilization, owing to the unparalleled scarcity of coal, was never so acute as at the present time," while "no book of a similar kind, in which the value of wood as fuel is explained, has before been written." The total timber felled per annum in the British Isles is now about 15,000,000 tons, of which 1,000,000 tons should be available for fuel. Another 1,000,000 tons could be obtained from field and roadside trees, besides considerable amounts from dead and dying trees, from pruning dead branches from living trees, and from stumps and roots. More space is given to methods of blasting stumps and roots than to the securing of wood from the more usual sources. The chief obstacles in the way of fully utilizing available fuel wood are the scarcity of labor and difficulty of transport. It is stated that material more than one mile from consuming centers is hard to dispose of. Drawbacks to utilization of wood fuel are the storage space required, and the bother of using wood as compared with coal. Vast quantities of firewood, charcoal and kindling wood were sent to France and Flanders for use of the armies, so that these products were hard to obtain at home. Prices within 12 miles of London were before the war about 10 shillings per cord (stacked on the cutting area apparently). At the end of 1918 the corresponding price was from 15 to 20 shillings per cord.

Firewood is usually taken to mean material from 3 to 8 inches in diameter; smaller twigs are classed as faggot wood. Firewood is usually sold by the stack—generally a half-cord or cord of 128 stacked cubic feet, although local custom in different districts has established cords of various sizes between 96 and 144 stacked cubic feet. A cord contains an average of about 1,000 pieces of firewood size. Wood is generally cut up and split by hand, although power saws are used on some of the larger estates. Faggots are used for ordinary fuel, for kindling, for baker's ovens, and for brick kilns, and are put up in bundles of several standard sizes, ranging from 9 inches long and 13 inches in circumference (called "pimps") to 4 to 6

feet long and 3 feet in circumference (called bavins). The cost of cutting and stacking firewood is given as 7 shillings per cord, and of making faggots 4 shilling 6 pence.

Some data are given on comparative values of different woods for heating purposes, together with notes on their manner of burning. No attempt is made to express these values numerically. It is stated that "heating properties of wood depend mainly on the amount of carbon that is contained in the woody fiber, as also the presence of oil or resin. To a large extent, therefore, the density of tissue and nature of its contents will determine the heating properties of our home-grown woods. . . . Age, soundness, amount of moisture contained, as also the presence of oil or resin, have all much to do in determining the heating power in proportion to the specific gravity of the particular wood."

Home-grown woods are divided into three classes according to heating power (on another page into four classes). These are: (1) Of greatest value: yew, hornbeam, thorn, oak, laburnum, hazel, laurel, beech, resinous old pine; (2) of medium value: apple, pear, ash, acacia (Robinia), birch, elm, maple, evergreen oak, sycamore; (3) of little value: lime, alder, horse chestnut, willow, spruce, poplar, larch, most of the pines. The average weight of a cord of mixed hardwoods is given as 3,100 pounds green and 2,100 pounds dry, and it requires fully 2½ tons of the best firewood (seasoned oak) to equal one ton of coal, so that "except for fire-lighting, the use of wood as a fuel in this country may, unless in the case of private estates, be looked at in the way of a luxury, the heating properties of even the heaviest or most resinous timber being far behind that of coal, while the expense of preparation is proportionately great."

A considerable part of the book is given to description of the method of making charcoal and discussion of its use for fuel and for making gunpowder. The army required great quantities for heating in the trenches where smoke was undesirable. Fair quality charcoal is made from the "black alder" or "dogwood," *Rhamus frangula*, a shrub or small tree native to southern England, which is cultivated for gunpowder charcoal in much the same way osiers are grown. Plantations are started from seed or by layering, and managed as coppice, cutting every six or seven years. Returns are much higher than from ordinary coppice timber. (Might it not be worth while to investigate the possibilities of some of our American species of Rhamus for producing high-grade charcoals?) The black alder wood contains 27 per cent of charcoal (presumably by weight, though the author does not

say so), as compared with oak 22 per cent, beech 19 per cent, willow and poplar 18 per cent, birch, alder and ash 17 per cent, Scotch fir and larch 16 per cent. An interesting table of heating values of charcoals from different woods is based on the time required to boil water. Beech charcoal is quickest with 11 minutes, elm, sycamore and holly take 13 minutes, hornbeam 14, hazel and thorn 15, ash and chestnut 16, yew and Scotch elm 20, laburnum 27.

The concluding chapter gives the fuelwood order effective October 1, 1919, which regulates the sale and consumption of wood fuel. This order defines firewood as all waste tops and tops over two inches diameter, and other timber unsuitable for sawn lumber or for pitwood, and mill waste. All such wood must be put at the disposal of the Board of Trade. No one may sell firewood at retail without a license from the local authority, nor may he sell outside of the district designated by them, nor more than two tons to any one consumer within 12 months, except in case of consumers who may be required by the local authority to burn wood in lieu of the coal allotted to them. The local authorities have power to order such substitution up to one-third of the individual's fuel allotment, on the basis of two tons of wood for one ton of coal. Such consumers have a priority right over all others for the purchase of wood. A maximum price of 15 shillings per cord for softwood and 20 shillings for hardwood is set for firewood stacked along a road or at the mill. This price may be modified by the timber controller. Local authorities may fix the maximum retail prices within their districts, allowing for costs of working up and delivering the wood, and may determine whether sales shall be made by volume or by weight. No dealer may sell except by the prescribed method. Local authorities may also require all retailers to make reports of all sales, and to give such other information as is needed. All contracts for purchase and sales of fuel wood except those with Government departments or with naval or military authorities, were abrogated effective October 1. Provisions of the order do not apply to fuel used by an owner or his servants, or wood given workmen as part of their wages, or wood gleaned by persons for their own consumption, or wood used for chemical purposes. W. N. S.

Timber: Its Strength, Seasoning, and Grading. By H. S. Betts, M.E., Forest Service. McGraw Hill Book Co. 1919. 234 pages, illustrated.

Although Mr. Betts' admirable book does not cover an entirely new field by any means, it is, nevertheless, the most complete publication

on the general subject of strength of wood in relation to its commercial uses which has yet appeared. The book is of convenient form and size to use for a reference book and also for a textbook in universities.

The subject matter covers four principal topics: (1) Statistical analysis of the timber supplies and cuts throughout the United States; (2) the strength values and factors affecting the same, both of wood intrinsically and also of manufactured products; (3) the seasoning of wood; and (4) the grading systems in use. The main part of the book has to do with the subject of strength and its application to commercial uses of wood.

While there is little that can be said to be entirely new in the book, wood users will nevertheless find the subject matter brought together in a convenient and easy form for reference. The material has been taken almost entirely from the various circulars and bulletins issued by the Forest Service, including Mr. Betts' own bulletin, "The Seasoning of Wood." Full credit for the material is given in the preface; it would have been interesting, however, to have had a biblography of the works quoted.

Mr. Betts has had long experience in the testing of yellow pine timbers of all sizes, and the summary of the strength and stiffness of natural and treated sizes is of special value, as it is based upon his intimate knowledge and experience in this line of work. It is interesting to note from comparative results given that Douglas fir stringers show a decided loss in strength in the modulus of rupture of the creosoted material, both before subsequent air seasoning and after thorough seasoning. In the boiling process this loss is shown to range in the unseasoned timbers from 18 to 52 per cent of the strength of the natural wood and after seasoning the loss in strength (modulus of rupture) is shown to range between 17 and 52 per cent for the unseasoned. In small sized pieces cut from the large beams the losses are much less, namely, from 17 per cent in the unseasoned to 2 per cent when air dried. The following is quoted from his deductions:

"1. Timber may be very materially weakened by the preservative process.

"2. Creasote in itself does not appear to weaken timber.

"3. A preservative process which will seriously injure one timber may have little or no effect on the strength of another.

"4. A comparison of the effect of a preservative process on the strength of different species should not be made unless it is one of the best adapted processes for all the species compared.

"5. The same treatment given to a timber of a particular species may have a different effect upon different pieces of that species, depending upon the form of the timber used, its size, and its condition when treated."

Mr. Newlin's (Forest Products Laboratory) famous density-strength curves are given in full, and the intrinsic strength values of American timbers taken from Mr. Newlin's bulletin, "The Mechanical Properties of Woods Grown in the United States," are reproduced in six folded inserts. These folded tables are very clearly printed, although of a somewhat inconvenient size for handling.

A discussion of the grading of structural timber with a classification of defects and methods used by the Forest Service in classifying defects for knots is fully discussed and illustrated, and comparisons of the common grading rules in use throughout the country are given.

A table for the working stresses permissible for structural timbers for twenty-three species is based on the tests and investigations of the Forest Service.

Tests for commercial articles such as telephone poles, cross arms, packing boxes, and vehicle parts are described and tables of data given.

It is of interest to note the statement that "there is little difference between the (southern yellow) pine and (Douglas) fir (cultivator) poles for most of the qualities measured, but the range was much greater in the pine poles than in the fir."

The following conclusions are quoted: "Spoke tests show an error of 50 per cent in the grading system used which is largely due to the traditional prejudice . . . against red hickory." "The superiority of hickory in toughness and shock resisting ability as compared with maple is brought out in the axle tests." "Shaft tests indicate that red oak may be substituted for hickory of the lower grades in shaft manufacture."

An original compilation taken from various sources showing the "Life of untreated woods" in the form of ties, posts, poles, and lumber is given in a table for 42 species. It is interesting to note that no partiality is shown between redwood and cypress, both being quoted with a life of ten to twelve years for ties and twelve to fifteen years for all other purposes.

Thirty-seven pages are devoted to the "Seasoning of Wood," which is a compilation of Forest Service literature. The discussion has to do primarily with the air seasoning of both timbers and lumber, with brief remarks concerning kiln drying, giving a classification of various methods used. Rules for piling lumber are given, being quoted from Department of Agriculture (Forest Service) Bulletin 552, "The Seasoning of Wood."

Considerable space is given to a discussion of the grading of lumber and grading rules. There are two principal sets of rules for hardwood

lumber—those of the Hardwood Manufacturers' Association and those of the National Hardwood Lumber Association. It may surprise some to learn that the latter rules cover over 400 grades. For grading softwood lumber there are a large number of different rules in use.

Statistics of the amounts of lumber manufactured and produced in the United States are given in a number of tables at the end of the book. It would seem that needless space has been given for this statistical matter, as it is necessarily somewhat out of date, and current values are published yearly by the Department of Agriculture.

A valuable feature is the index in the back.

The book should be in the library of every manufacturer of wooden products, as well as that of structural engineers.

H. D. T.

Relative Resistance of Various Hardwoods to Injection with Creosote. By. C. H. Teesdale and J. D. McLean. Department of Agriculture Bulletin No. 606.

Experiments were made in a pressure cylinder and also with a specially designed "penetrance apparatus" on most of the commercial hardwoods to learn their relative resistance to treatment with coal tar creosote. The results of the tests which are given in detail are useful in grouping species for treatment so that species of similar resistance may be treated together. G. M. H.

Field Tests Made on Oil Treatment of Wood Against Marine Borers. By C. H. Teesdale and L. F. Shackell. Eng. *News-Record,* 1917. Pp. 833-7.

Service tests on samples of piling treated with various preservatives by the Forest Products Laboratory indicate that creosote oil for marine work should contain a large proportion of constituents boiling above 320° C., as well as considerable amounts of high boiling tar acids and bases. The specification for distillate oil for paving blocks adopted by the American Wood Preservers' Association in 1917 is considered the best standard specification for the purpose.

Deep and uniform penetration of the preservative is necessary, as spots of little or no penertation allow the borers access to the untreated interior.

Xylotrya, which enter untreated wood and gain any appreciable size, can then bore into treated wood and withstand considerable quantities of preservative with impunity.

Detailed results with various preservatives are given.

G. M. H.

Notes sûr les Forêts de l'Algérie. By. M. Marc, Inspecteur des Eaux et Forêts. Government General de l'Algérie. Direction des Forêts. Alger. 1916. Pp. 331.

This administrative and financial review of forestry in Algeria is perhaps the most complete and painstaking official report of the kind that has been published by any colonial administration. It is a high-class reference work on the administration of Algerian forests, illustrated with 14 diagrams, with an admirable map of the forests suitable for exploitation, and the established railway systems. The book is divided into eight chapters:

1. Forest receipts.
2. Collection of cork oak.
3. The forests and railway charges.
4. Forest improvements.
5. Forest fires.
6. Measures in favor of the natives.
7. Alienation of forest land.
8. Role of the Forest Service in Algeria.

Of these eight chapters, 2 and 5 contain information of most value to American foresters.

On January 1, 1915, the French state forests of Algeria totaled 2,237,509.46 hectares, divided into three districts:

Conservation	*Total (hectares)*	*Cork Oak (hectares)*
Algiers	479,813.31	41,078
Aran	751,479.46	7,354
Constantine	1,006,216.69	391,910
	2,237,509.46	440,34?

In round figures, the forests comprise 5-6/10 million acres of all classes of forest, of which one million acres is cork oak; thus the valuable cork oak forests comprise only 15 per cent of the total area. But only 275,494 hectares of cork oak were under the control of the conservators, since 164,848 hectares was tied up in long-term contracts so that the State's cork oak areas are but 12 per cent of the total. This proportion is emphasized because during the period 1911-1913 the total annual revenue averaged 5,480,636 francs and the cork oak yielded 4,139 francs *or eight-elevenths of the total revenue.* This proves the justification of the vast expenditures for the protection and improvement of this type of stand. The additional revenue is derived from fuel, lumber, ties, tanbark, turpentine and resin, hunting

rights, minor products, grazing, damage claims and payments for the concessions of cork-oak land authorized under the law of Feb. 2, 1870.

The steady increase in total revenues is a credit to the forest administration. Beginning at 354,602 francs in 1890, it was 5,523,783 francs in 1913. Owing to the war the receipts dropped in 1914 and 1915 to about one-third the normal amount! The expenses, however, are heavy, since the cork is cropped and marketed by the State. In 1890 the expenses were almost 2 million francs, about six times the receipts, while in latter years the expenses had risen to 4½ million francs, about four-fifths to two-thirds the revenue. During the period 1903-1913, the forests have been improved and yet yielded a total net revenue of 8,728,092 francs. The yield per hectare has increased from 0.71 francs in 1890 to 2.86 francs in 1911-13. But if the revenues for the cork oak forests (275,000 hectares) are taken alone, the yield is 16 francs per hectare per year and the yield for the remainder of the forests land but 1 franc. The cork-oak yield per hectare was 55 francs in the Algiers conservation, 5 in Aran, and 12 in Constantine.

It is of interest that the value of cork oak per quintal averaged 30.58 francs in 1906-1910 and 33.65 francs in 1911-1913—an average ot about one and one-fifth cents per pound.

In weighing these revenue figures we must bear in mind that about a million francs of free use was disposed of each year.

M. Marc discusses at length the disadvantages of the long-term cork-oak land leases, the sale price having been less than 9.03 francs per hectare in one lot of concessions, involving losses of enormous extent considering the average revenue of 16 francs from similar land held today by the Service des Eaux et Forêts. Beginning July 16, 1891, no further concessions were made by the director of forests; instead the forests were to be improved, managed, and exploited by the State. The cost of producing cork has fallen from 23.7 per cent of the sale price in 1891-1895 to 17.6 per cent for the period 1911-1915. Nor is France impoverishing the forests for the sake of revenue, having spent for improvements:

Kind of Improvement	*Francs*
Forest houses	3,483,173
Roads	6,864,288
Fire protection (fire lines chiefly)	706,045
Forestation and cultural work	2,346,294
	13,400,000

This money, being charged to capital, was secured by Algerian loans. It is especially interesting to see that an average of $2,000 was

spent per house. Marc apologizes for the small amount of forestation, because the area forested in the Tell Mountains and Hauts-Plateaux amounts to only about 13 per cent—a percentage too low for the type of climate and soil. He calls attention to the need for more forestation.

The general wood business remains small, chiefly through lack of transport. During the six-year period, 1909-1914, the average production was:

Fuel	123,028 steres (3.6 steres to cord)
Lumber	23,227 cubic meters (about 4½ million board feet)
Ties	116,485 pieces
Poles	195,759 pieces

This total production from State forests is only 94,357 tons. Marc states, "The small importance of exploitations which, despite the progress made in the last 10 years, are still very limited, is due for the most part to the absence of means of transport. . . ." Moreover, the tariffs for wood products are much higher than in France to the detriment of the increase in production.

Chapter 5 (Forest Fires in Algeria) is of especial interest to the American forester, who will agree that the fire hazard is due chiefly to the natives, to the periods of drought, coupled with high winds, and to the large amount of inflammable undergrowth which is especially dense in cork oak forests. A feature of this chapter is the very complete data on fires for the years 1873-1915. This data shows the periodicity of bad fire years, and curiously enough that the damage in 1915 (when one might have supposed that lawlessness would have increased the fire danger) was far below the average. From 1873 to 1915 the greatest loss in any one year was 9,042,440 francs in 1881 and the minimum 90,093 francs in 1904. It would be interesting to compare the fire damage with rainfall returns for this period; this the author has failed to do. He states, however, that a bad fire year must be reckoned with every ten years. If this is true, the next disaster will be in 1926.

Most of the damage has occurred in cork-oak forests and the total damage since the occupation by the French is estimated at 60,000,000 francs. Unfortunately, in cork oak the fires recur in the most dangerous localities, and at Bone there is 16,000 hectares and at La Calle 32,000 hectares where the production of cork will be stopped for 25 years—an estimated loss of 25,000,000 francs. In the alepo pine, the loss to the standing timber is usually severe, but regeneration comes in, as it does with lodgepole in our Rocky Mountains. The damage

to thuya is lessened because this species sprouts vigorously, as does the holm and kermes oaks. The loss to cedar is small because it grows at the higher altitudes and is only found in scattered stands. While the undergrowth is of little value commercially, Marc advocates its protection for general conservation reasons—soil cover and protection against erosion. In this dry region with dense undergrowth the effect of fires has been to *increase the fire risk* and to decrease the returns to such an extent that without efficient fire protection the future of the forests of Algeria will be in danger.

Only 60 per cent of the fires commence within the forest and the causes are classed as follows:

Accidental	8 per cent
Carelessness	32 per cent
Intentional	23 per cent
Cause unknown	37 per cent
Total	100 per cent

So long as Algeria is peopled by Arab tribes forest fires will probably continue, owing to the ignorance, carelessness, and jealousy of the native population. The only way to really stamp out fires in the valuable cork-oak stands would be to clear out the undergrowth—impracticable because of the expense. Even the plan of hiring the natives for fire duty (instead of requiring assistance without pay) will probably fail. At present natives whose grazing grounds are burned may be excluded for six years, a measure of doubtful value because of the hatred this exclusion has engendered—leading to the further setting of fires by those whose livelihood is threatened.

From 1906 to 1914 there were 462,000 hectares open to 318,000 sheep, 1.1 per hectare (1 sheep to 2.7 acres). During the same period 287,000 cattle, camels, and burros grazed on 1,163 hectares, about 10 acres to each animal.

Land classification is along narrower lines than in the United States, and every effort is made to prevent small interior holdings. The woodland zone is largely retained as forest land not only because it is considered necessary for soil protection, but also because it will become forest land of the future and on account of the great difficulties of forest extension in a dry country. A public commission held in 1904 "that the conservation of existing forest, *including the woodland,* is for Algeria . . . a question of public safety," since the colony is only 13 per cent forested. It is for this reason that the State passes on all requests to clear forest land. Yet during 1905-1915 clearing

was only refused on 25,555 hectares out of a total of 177,090!

Foresters interested in the administration of public forests (as well as the teacher) will do well to study Marc's excellent notes.

T. S. W., Jr.

The Ecological Relations of Roots. By John E. Weaver, Carnegie Institute of Washington. Publication 286. Pp. I-VII and 1-228, with 58 figures and 23 plates, three of which are in colors. 1919.

It is only in recent years that American botanists and foresters have given serious attention to the study of root habit and root systems. The labor involved in excavating and tracing root systems to the depth in some instances of ten or more feet and the difficulties met with in following delicate roots through the soil and sub-soil has deterred investigators from attempting work in this fruitful field. For many years, however, students of silviculture have recognized the need for more and better information on the root habit of trees in order better to correlate forest vegetation with the site factors. More recently plant ecologists have appreciated the need of investigation in this field, and the light which careful work therein is likely to throw on a number of unsettled problems in plant distribution.

More than twenty-five years ago Keffer, working for the Division of Forestry in the United States Department of Agriculture, traced the root system of a number of tree species, growing in the Dakotas and elsewhere in the West. More recently Cameron and Markle have studied the root systems of desert plants and Sampson has studied the root systems of range plants. Some fifteen years ago the writer of this review studied the initial root habit of some one hundred and fifty species of indigenous trees grown in nurseries and investigated the root systems of a large number of western conifers growing under natural conditons in many habitats from the Black Hills of Dakota to the Pacific Coast. His investigations were confined to the early stages of root growth, namely, the first five years after germination. The results still await publication. Recently Korstian has studied the roots of certain western plants as indicators of conditons of soil moisture.

Weaver's recent publication contains descriptions of the character, depth and distribution of the roots of about 140 species of plants, none of which, however, are trees. Approximately 1,150 individual plants were examined in eight different communities: (1) Prairies of eastern Nebraska, (2) chaparral of southeastern Nebraska, (3) prairies of southeastern Washington and adjacent Idaho, (4) plains and sandhills

of Colorado, (5) the sandhills anti-climax, (6) the gravel-slide, (7) the half-gravel-slide, (8) forest community of the Rocky Mountains of Colorado.

Trenches were dug to a depth of about 6 feet by the side of the plants to be examined. These trenches were deepened where necessary as the investigation proceeded, sometimes to a depth of 16 or more feet. The author states that by use of a hand-pick with a cutting edge, practice made it possible to excavate a root system almost in its entirety. The reviewer has found in his work on root systems that with young trees two or three years old it is almost impossible to remove the root systems from heavy clay and stony soils without breaking off many of the tender root tips.

In all cases the roots examined by Weaver were those of mature perennial plants. A large number of excellent line drawings and photographic reproductions supplement the descriptions.

The description of representative root systems from each of the eight communities is followed by a more or less complete account of the climatic and edaphic factors of the site where the root systems developed.

In the prairie environment of eastern Nebraska 55 per cent of the species investigated had root systems extending to a depth of 5 feet or more. The cause of this remarkable development of shrubs and herbaceous perennials is assigned to the disposition in the soil of available water in the prairie environment. The writer states that the prairie plants of this region grow under semi-arid climatic conditions in which the supply of water is the chief limiting factor of plant growth. During certain parts of the growing season it was found that the water content of the soil may be reduced to the non-available point to a depth of 4 or 5 feet, and at times when the evaporating power of the air is very high. The very deep and extensive root systems are a response to deep soil moisture at times of drought.

Without attempting to review the author's studies and conclusions from six of the communities examined, all of which are of great interest, the review of his study of the forest community in Colorado is presented as a contrast to the prairie community. The forest community studied is represented by *Pinus ponderosa* and *Pseudotsuga mucronata* as dominants, both of which are frequently preceded by a chaparral stage. The root systems of a large number of herbs and shrubs characteristic of the more mesophytic type of forest were examined.

It was found that the herbs and shrubs of the forest floor are relatively shallow-rooted, lying for the most part in the upper 18 inches of soil. Here as in the prairie environment the water content of the soil offers the logical explanation for the disposition of the root systems. It is to be regretted that the author was unable to examine the root systems of forest dominants. The only parts of the root systems of the trees examined were those lying in the upper eight inches of soil and the depth of root penetration was undetermined. In the reviewer's opinion, this is a fertile field for research, and it is hoped it can become at least a part of the work of one or more of the forest research stations.

In this forest community the sub-stratum furnishes an excellent medium with a high-water holding capacity to catch the precipitation of winter as well as that of the frequent summer showers. The shade of the dominants reduces the evaporating power of the air, while water loss from the soil is retarded by the layer of duff. Studies on the disposition of soil moisture showed that the greatest amount of available water during the growing season from June 10 to August 19, 1918, was in the upper 18 inches of soil. The layers from two to three feet below the surface were found considerably dryer. The reviewer ventures the opinion that the large demand on soil water at depths below 18 inches by the tree dominants is an important factor in causing the surface layers of the soil to hold more available water during the growing season than layers at a depth of two or three feet.

If the overwood were removed it is very likely the deeper layers would contain more available water during the growing season than the surface layers.

A number of species were encountered and excavated in two or more of the communities. Of the ten polydemic species described, each growing in at least two different habitats, seven showed very marked changes in their root habits, while two made practically no change, and one exhibited but slight change. In this connection it might be noted that the reviewer in his study of the initial root habit of more than one hundred and fifty woody species found that the root habit of certain species were much more amenable to change under change in habitat than were others. Thus the hickories produced the same form of initial root under various soil conditions, while the red maple, on the other hand, varies its root habit with the slightest change in soil conditions.

In general it may be said that the root systems of a species are often as marked and distinctive as are the above-ground vegetative characteristics. The root systems of different species, even of the same genus, may be of entirely different types. The writer concludes that a knowledge of position and competition of roots is indispensible in explaining the phenomena of succession. It greatly increases the usefulness of plants as indicators of agricultural and non-agricultural land. It helps in solving the problems of competition of range species and the improvement of the range. If the root systems indicate the distribution of soil moisture in various habitats their study should be of material aid to the forester in selecting sites for reforestation or afforestation.

It is hoped that this admirable work by Weaver will stimulate other botanists and foresters to undertake research in this fruitful field.

J. W. T.

Some Information About Chinese Wood Oil. By D. Y. Lin, M.F., University of Nanking. *The Far Eastern Review,* Sept., 1919.

Wood oil or tung oil ranks third in importance of the vegetable oils produced in China, the first two being soya bean and peanut oils. It is used chiefly in the paint and varnish industry, being particularly in demand in the United States. Almost the entire output is from the provinces of Szechuan, Kweichow, Hunan, and Hupeh, besides the Kwangsi product. During the five years 1914-1918, the total export abroad and to native ports amounted to 3,572,297 piculs, or 238,154 tons. Of this amount, 2,154,597 piculs, or 143,640 tons, were exported abroad. The annual exports have fluctuated considerably in quantity, showing on the whole a decrease, due largely to political disturbances. On the other hand, the value has increased. Thus the foreign exports for the years 1915-1918 were worth (in round numbers) \$1,868,000, \$4,254,000, \$4,981,000, and \$7,530,000, respectively.

This oil is obtained from the seeds of two species of *Alcurites*, namely, *A. montana* and *A. fordii,* the latter supplying about 90 per cent of the total. The trees grow on poor, rocky soils, withstand drought and heat, and are hardy as far north as 24° or even farther, though they often fail to fruit in the colder regions. The trees grow rapidly, but are mostly rather bushy, with a height usually not over 20 feet and a diameter of 6 to 10 inches.

Plantations are mostly on hillsides, the spacing between about 11 feet each way. They are started either by direct seeding or, less commonly,

by the use of one-year seedlings. The trees begin to bear in from 3 to 7, usually 4 to 6, years, depending upon the variety and the site, and continue to do so for about 10 years. If conditions permit, other crops, such as tea, are grown between the trees for the first two or three years.

The fruits, which look like large hickory nuts, ripen in September, whereupon they burst open and release the 3 to 5 triangular seeds, each of which is about as large as the end of one's thumb. In practice the fruits are gathered before they are ripe, are then placed in iron pans about two feet in diameter and stirred about over a good fire until the husks are parched and fall away from the seeds. Another process is the pit method, in which the husks are disposed of through natural fermentation.

"The process of extracting the oil is very simple. The seeds are placed in a circular stone trough where they are crushed by a heavy stone roller drawn by buffalo, cow, or ass. The pulverized mass is then partially roasted in shallow pans, after which it is placed in wooden vats, fitted with wicker bottoms, and a further steaming process takes place over boiling water. Next with the aid of an iron and straw, the meal is made into circular cakes. These cakes are arranged edgeways in a large press and when full, the pressure is applied. This is usually accomplished by a system of wedges which are driven in one after another by means of a huge battering ram until the brown, somewhat watery and heavy smelling oil is crushed out into the vat below. The oil is then collected in vessels, is slightly heated, and after being freed from sediment by straining through coarse grass cloth is ready for market. Often, however, the heating process is carried too far, and the oil becomes dark brown instead of retaining its desired light yellow color. As a rule the oil yield is about 40 per cent of the original weight of the kernels. The refuse cakes are used as fertilizers."

"The wood oil consists chiefly of the glycerides of oleic and elacomargaric acids. According to Fahrion it contains 2 to 3 per cent of saturated fatty acids and about 10 per cent of oleic acid. On keeping wood oil becomes jellified and solidifies partly. It is readily identified by its strong characteristic smell. Its specific gravity is higher than that of any known oil excepting castor oil. On account of its pronounced drying power, wood oil has been frequently used as a substitute for linseed oil, whose drying properties are not as strong. The oil is very poisonous when fresh. The refractive index of wood oil is higher than that of any known fatty oil. The tung kernels contain about 53 per cent of oil but the secured yield of oil under native processes amounts to only 40 per cent."

The author believes that the yield and richness of the nuts can be materially improved by proper breeding and cultivation. He advocates the use of simple extracting machinery which will remove more of the

oil; also of some device for regulating the heating process. He suggests the establishment of small local depots in the various producing centers to assist in handling the crop. Merchants interested in the trade should seek to standardize their product and take the necessary steps to prevent adulteration. S. J. R.

Tight and Slack Cooperage Stock Production in 1918. By F. H. Smith and A. H. Pierson. Forest Service. 15 pp.

The interest in this publication lies in the fact that since 1909 and especially 1911 the output, both of tight and slack cooperage, has declined considerably, the decline of different items amounting to between 20 and 57 per cent. The prohibition movement probably accounts for the decline in tight cooperage, and substitution of other containers in that of slack cooperage. Arkansas is by far the greatest producer of cooperage, due probably to its oak reserves, oak furnishing 67 per cent of tight staves and about the same percentage of slack staves.

Report of Dr. J. E. Campbell Upon the Results of His Visit to Europe Investigating the Conditions in the Paper and Pulp Industry. May 14, 1919. 13 pages.

This report is addressed to the Gentlemen of the Wrapping Paper Manufacturers' Service Bureau, but contains much information of general interest. It covers the paper situation in England and France, but the part of special interest to foresters is that dealing with Scandinavia. Of Sweden he says the export of wood fiber amounts in value to 12 per cent of the total export trade of the country. The increase in production of sulphite pulp has gone from 150,000 tons per year in 1900 to 675,000 tons in 1912. Mechanical pulp increased from 110,000 tons to 340,000 tons, and sulphate pulp from 40,000 tons to 140,000 tons in the same period. The exports of chemically produced pulp have increased from 125,000 tons to over 600,000 tons in this period.

Every sulphite mill which owns timber limits, as well as the Government and private owners of forest lands, have established a most important branch of their several activities, known as their Forestry Department. These mills have expert and technically educated foresters. There is no arbitrary rule that all trees of a certain diameter shall be cut. Each tree which is cut is bored with a special tool, and

the rings of growth are carefully examined, and where a tree is found not to be showing the same yearly average increase of growth as the general tree average in that section, such tree is marked for cutting. In other words, they remove the slow growers. The timber is cut into 8-foot lengths and each piece is hand-shaved in three parallel lines, removing a 2-inch strip of bark. This is done for the purpose of assisting the log in drying, thus materially reducing the loss in driving.

The forestry departments of the mills have very accurate figures in regard to the yearly growth of their forests, and they do not cut more timber than grows each year. Any excess wood used is purchased from Government limits and privately-owned tracts. This relationship between growth and cut was generally maintained throughout Sweden up to the time of the war, but has been upset by the fuel situation. There is little coal in Sweden and the country has relied on English coal, paying in normal times $2 to $2.50 per ton f.o.b. English port. At the present time coal is worth from $45 to $55 a ton and is little used. Hardwood has therefore been largely substituted, not only as a domestic fuel, but for the industries including the pulp mills. Even the locomotives are burning wood. This enormous use of wood fuel has seriously broken the balance between the amount grown and the amount cut.

There is a firmly established principle among these mills to invest their surpluses in timber limits, and some mills have invested in Russian limits. As soon as a stable government appears in Russia there will be a general movement in this direction. Norway has for years been buying pulpwood from Russia, mostly in the region of the Riga. The present cost of wood in Norway amounts to about $57.57 per ton of sulphite pulp, bringing the cost of the pulp f.o.b. mill up to $100 per ton of 2,000 pounds. The cost of wood in Sweden is somewhat lower, and is less in northern than in southern Sweden. The cost of wood per ton of sulphite pulp in these two regions is $31 and $43 to $47 respectively. The cost of manufacturing sulphate pulp in Sweden increased from $27.44 per ton in 1913 to $98.62 in 1919. The chief items causing this increase were the rise in wood from $14.75 to $42.50; fuel, $2.50 to $26.10; pyrites, $1.30 to $7.75; wages, $3.14 to $9.25; freight to Gothenberg, $1.21 to $4.02.

There is also much interesting information on the labor situation, the financial condition of the mills, etc.

A. F. H.

The Forest Ranger. Collected and edited by John D. Guthrie. The Gorham Press, Boston. $1.50.

These are reclassification days—"sure enough" in Washington, to all intents and purposes elsewhere—and the old embarrassing question of "what is a forester?" is again before us. To herd all the unruly views offered into a short definition that will satisfy everyone is work for a genius. Such a definition must show forestry not as a formula but as an intensely "human" occupation. There being, in forestry, nothing more admittedly human than the forest ranger, there is something opportune in the appearance at this time of the first published book of verse of, by, and about the forest ranger. "This little book," says the compiler, "is sent out with no literary aspirations whatever, but only with the desire to bring together and put on record these expressions of the spirit of the men who have heard the call of the forest and of distant places, and in the hope that they may bring back pleasant memories of many a forest camp or meeting."

The compiler dedicates his book to the enjoyment of the men in the profession. Its service is really greater than this, for it gives to us and to the "outside public" the first glimpse—whimsical, fantastic, fragmentary, but apparently authentic—of what forestry means to the man on the job. The job, in fact, is the dominant feature in the 95 selections collected by Mr. Guthrie. It appears both as "statement rendered" and "payment submitted." Under such titles as "The Busy Ranger," "The Forest Loafer," "When the Ranger's Feet Get Cold," it is the propelling force—the source of inspiration, profanity, and achievement. In "This Job," "The Suping Supervisor," and "The Desking Districter," it is the mandate handed down and the results footed up. If the ranger's tribulations are sometimes set forth in a way that might suggest—to the uninitiated—a Society for the Prevention of Cruelty to Forest Rangers, the same is the sad case of the supervisor, who appears, after all, only a sort of glorified ranger. It is apparent that the book is a sidelight not so much on forestry as on the U. S. Forest Service. It frankly reflects a common organization as well as a common aim. Those who find this limitation unfortunate should consider that no other working organization of American foresters has so large or so close-knit a personnel to draw upon. With its morale and traditions already formed and forming, it is not strange that the first collection of verse should come so largely from the Forest Service. The compiler's hope that it "may

be the forerunner of a collection of folk songs of American foresters and forest workers" should, however, meet with a forthcoming response from all forestry sources.

In spite of his ample duties and remarkable diligence the ranger is still supposed to find time to ponder upon the wonders of nature. In this composite most of the pondering has been assigned to Scott Leavitt, whose "Night Call," "The Trail," and "Sun River Pass" add materially to the quality of the collection. Several selections taken from outside the forestry personnel also contribute in this respect, among them a number by Arthur Chapman and W. P. Lawson. In a short review it is impossible to refer by name to all who have contributed good verses. Leopold, Ivey, Constance Mainwaring, Harris, Will Barnes, Guthrie, and Plummer have given some of the best.

On the other hand—with apologies to the compiler for disregarding his plea as to "literary aspirations"—there is not much reason for complacency in these selections. It must be admitted that forestry has not yet developed a Douglas Malloch, let alone a Kipling or a Masefield. There are naturally many faults, and the worst seems to be a self-consciousness that makes many of the pieces unattractive to the discriminating reader. The writers of too many obviously regarded themselves as spokesmen. They wrote not for their own satisfaction, as did the cowboy making up a ballad, but for the edification of others. This is a fault of many of the pieces; but a few welcome exceptions—"Only a Little Tree Button," "A Ranger's Day," "A Ranger's Joys," "The Government's Handy Man"—may be cited in which this fault is not oppressive. The introduction of propaganda in a book of this character also appears unfortunate, yet some decidedly sober propagandist pieces have been drawn in, like coals from Newcastle. Possibly the gravity was needed, in the compiler's opinion, to balance "Wireless Bill," "The Song of the Ohmlette," the "Bugland Lullaby," and "The Mystery," none of which can be accused of excessive sobriety.

It is customary to speak of the ranger as the successor to the cowman. The cowman's ballads, like the deep-sea mariner's chanties, grew out of their distinctive callings; should not the ranger, with an equally distinctive calling, also produce a characteristic anthology? Possibly it is too early in the life of the profession to expect such songs, or possibly the space available was too limited; however this may be, the collection appears singularly deficient in actual, singable songs. Nine of the selections, it is true, are apparently adapted to

music, but most of these are parodies, and few have that universal quality which would give them the wide usage of such soulful songs as the "Cowboy's Lament" or the "Dying Cowboy." The one of these which comes closest to filling the bill is "The Little Still," reminiscent of wet days, the Biltmore Forest School, and the Southern Appalachians. This is undoubtedly the most widely known and most characteristic of the forestry songs; but it has nothing of the ballad character, and in this book it appears without the music. It seems unfortunate that Lovejoy's ranger song of the many verses—a ballad of the whole Service and with something of the old cowboy ring—was omitted. This must remain for another edition, which we may hope will contain more of the same, with the music to sing them by.

This collection is far from exhausting the available material. "The volume here presented," says the editor's note, "includes less than one-half of the total number (of verses) collected, and only the ones believed by the writer to reflect most truly the forest ranger's life and work have been included; many that were received were of too personal a nature or possessed a superabundance of local color to be of general interest to foresters and forest officers."

The compiler is right in resigning claim to "literary aspirations." Let the songs be forthcoming and merit will, in the end, look out for itself. For the "folk songs" of which we may hope with the compiler that this book is a "forerunner", however, we would suggest that the place to seek this collection is not in the writings of those who would speak for their fellows, but in the ranger's own camp, where words come naturally, with the smell of wood smoke and frying bacon, to fit the tunes of the times or to suggest new ones. The compiler must be keen to follow Professor Lomax's example and take down the verses which thus spontaneously arise.

This book should be hailed by all foresters as an accomplishment and a source of inspiration. As the outcome of a movement thus set on foot, we may look forward to a book of verses that would suit Omar underneath his bough, even though the jug be missing.

E. H. F.

PERIODICAL LITERATURE

STATISTICS AND HISTORY

German Forest Resources

G. Huffel, the veteran French forester, argues that the Germans must restore or replace forest resources that were lost by the French and Belgians. Speaking especially of France, he concludes that "our forests will not be restored to their former value for a century." Houses can only be rebuilt, while forest growing stocks can only be replaced by economy for many decades. With the increased wood requirements in France, such a saving would be impossible unless the Germans can be made to furnish the necessary raw wood products for French industries and for reconstruction. The reason is clear. France used (before the war) 11 million cubic meters of lumber and produced but 6 million—thus importing almost 5 million. The normal consumption for five years was thus 55 million, but for the period 1920 to 1924, Huffel estimates France will require 160 million cubic meters, and concludes that Germany must furnish this deficit. To show that this is practicable, he summarizes German resources from the official statistics for 1900. The totals are interesting: 8,270,133 hectares (Prussian) and 13,556,037 (total all states without Alsace-Lorraine) estimated to yield by clear cutting the following number of cubic meters on the stump (on reel):

Volume in thousand cubic meters.

Age class	Oak	Beech	Scotch pine	Spruce and fir
61- 80	6,380	35,500	71,400	57,690
81-100	7,800	47,100	67,300	63,120
Over 100	27,510	91,410	96,050	79,680

Grand total, 652,000,000 thousand cubic meters.

Of this amount the States own 338 million cubic meters (about 84½ billion board feet, counting 4 thousand cubic meters to 1,000 board feet), of which 183 million cubic meters is over 100 years of age.

Huffel shows that to cut such an amount in a few years would be clearly impossible. But with an output of 3 cubic meters per man per day, 50,000 men would furnish France with the required raw wood supply in a period of five years and have some left over for England and Belgium. The normal German production was 20 million cubic

meters per year. Provided Germany is unable to pay in money, a payment in raw wood may not prove so chimerical, although *such a cut would deplete German growing stocks.* Huffel also summarizes the resources of "Austria."

T. S. W., Jr.

Bulletin de la Société Centrale Forestiere de Belgique. July, 1919, pp. 172-179.

SOIL, WATER, AND CLIMATE

Studies in the Ecology of Tropical Rain-Forest

McLean has made a study of the effect of certain habitat factors on the tropical rain-forests of southern Brazil. The object in view in making the investigation was primarily the estimation with what exactitude might be possible of some of the ecological factors included under humidity, and illumination and ascertain so far as possible how these factors affected the vegetation, particularly the plants under the forest canopy, morphologically or otherwise, in relation to the transpiration problem and the assimilation problem. The instrumentation and methods employed were those suggested as the study proceeded and that circumstances permitted.

The study was conducted in the rich forest on the hills and in the valleys round about Rio de Janeiro, southern Brazil. The article undei review includes the introduction and Part I of the complete research. Part II will be published in a later issue of the *Ecological Journal.*

There is an excellent though not exhaustive account of the general topography and climate of the region; the data relating to climate were for the most part compiled from the records of the national observatory in Rio de Janeiro, and those of the "Horto Florestal," the government cultural experiment station. The climatic data discussed relates primarily to air temperature, atmospheric humidity, precipitation and sunshine. In the correlation of these factors with vegetation the author develops a method for combining the records of the several climatic factors in a single graph representing the variation-cycle of climatic favorability.

The more important conclusions the author draws from his detailed study of humidity and illumination in their effect upon the transpiration and assimilation problems are:

(a) Under the peculiar climatic conditions prevailing within the undergrowth of tropical rain-forest, practically isolated from the influence of external changes, there is in general very slight transpiration and a correspondingly low rate of aqueous evaporation.

(b) Both absorption and conduction capacities are developed only on the low scale.

(c) The leaves show no adaptation calculated to aid in extending their transpiration towards the limit of capacity. On the other hand they are commonly protected by cuticle and other means against excessive water-loss.

(d) Shade leaves have a greater internal surface relative to their mass than sun leaves. This does not appear to be a transpirational adaptation, but as the illumination is very slight, it may be better interpreted as a means of increasing the CO_2 absorption capacity, the percentage of carbon dioxide in the forest air being supernormal.

(e) It has been found that the average of intercellular space in leaves examined in Brazil corresponds closely to that found in Europe. This may be associated with the constancy of leaf function over the whole world and the corresponding constancy of atmospheric constitution.

(f) Lack of capacity to increase the transpiration current under the stimulus of sun-flecks, wind, etc., leading to the necessity of protective devices, seems to point to edaphic factors antagonistic to absorption.

(g) Whether the suppression of foliar evaporation signifies the suppression of a water current in the axis does not appear. It is not impossible that a slow current is maintained by root-pressure, enough to satisfy the demands of elastic growth and of CO_2 assimilation, which between them utilize the major portion of the water supply, some part of which also returns through the phloem or may eventually be excreted in the fluid state.

In such circumstances the measurement of water-loss would give no indication of the absorbing capacity of the plant, of which it would be quite independent. J. W. T.

McLean, R. G.: Studies in the Ecology of Tropical Rain-forest, with Special Reference to the Forests of South Brazil. *The Journal of Ecology,* Vol. VII, Nos. 1 and 2, pp. 5-54, May, 1919.

SILVICULTURE, PROTECTION, AND EXTENSION

Beginnings of Revegetation in the Katmai Valley

The problems centering in succession are becoming more and more problems of basic interest to the forester. Through complete or partial denudation vast areas are annually brought into a condition where vegetation must begin its long process of bringing back the climax forest. It may be of beech and maple or of spruce and pine. How long nature takes to clothe a completely denuded soil or a new soil with forest vegetation necessarily depends upon local conditions and the circumstances surrounding each case. The time required, however, is of particular importance in American forestry, due to the vast areas of forest annually denuded by fires and partially denuded by our destructive methods of lumbering.

In the Katmai district in Alaska a study has been made by Griggs not only on the effect of the great eruption of Mount Katmai on plant life but on revegetation as well. The eruption which occurred in 1914 covered the entire region with a deep layer of volcanic ash, which in places left the country absolutely without living plant life. The paper under review is a record of the first stages in revegetation in the valley of the Katmai River.

It was ascertained that at Kodiak and at other localities with broken and abrupt topography the deep covering of ash was rapidly removed by erosion and the first vegetation to appear after the eruption was chiefly the old perennials which had survived and come up through the remaining ash cover. In the broad, flat valleys such as those along the Katmai River, the ash covering was less rapidly removed by erosion, the antecedent vegetation was more completely destroyed and the deposit of volcanic ash was deeper. Here the only survivals were certain woody plants which protruded through the layer of ash and perennial herbage which came up in places more or less completely cleared of ash. In the main, poplars, birches and alders have not survived sufficiently to be of consequence in revegetation. Several species of willow, however, have completely recovered and are already becoming an important factor in revegetation. The perennial herbage surviving the eruption is of little importance in the revegetation of the Katmai Valley.

Throughout almost all of the valley revegetation is chiefly dependent upon seedlings which start from seeds from adjacent regions. Due to the rapid removal of the ash from the adjacent mountain slopes, there were adequate survivals of woody plants and herbaceous perennials on these slopes to provide ample seed to restock Katmai Valley, as most of the species have seed adapted for wind dissemination.

Although seedlings were beginning to start on the deep covering of ash in 1915, they were few and scattered. The next year a definite change was noticeable and the beginnings of a new vegetation was apparent. Lupines were the most effective pioneers, although many additional annuals and perennials were appearing on the moister sites.

Examination of the soil shows it extremely poor in micro-organisms and nitrogen.

Four species of willow constitute the first woody vegetation to start from seeds. In some localities the ground was well covered with the young seedlings two years after the eruption. Present indications appear to show that the pioneer growth over considerable areas will be a willow thicket.

The pioneer vegetation throughout the area is most abundant in wet places. The author expressed the opinion that the better survival and growth in the wet places is due to the concentration of salts resulting from evaporation from the free water surface. The ash contains such small amounts of soluble salts necessary for plant life it may be supposed that only when concentrated by evaporation do they occur in amounts sufficient to sustain vigorous growth.

The distribution of the pioneer vegetation was found to be largely due to the irregularity of seed distribution. The absence of vegetation on undisturbed ash surfaces was due to the fact that the smooth surface afforded no lodgment for the seeds distributed by the high winds of the region. For the most part, the seeds found lodgment in wet places and in depressions, and it was here that most of the pioneer vegetation appeared. Thus in a bear trail over an otherwise denuded flat there was an abundance of herbaceous and perennial plants in each depression made by the bear's feet in walking over the flat.

In general it appeared that wind erosion was a great detriment to revegetation in wind-swept Katmai Valley. So also revegetation was greatly retarded by shifting streams. Although the instability of the ash soil due to wind and water appeared to overshawod all else in the problem of revegetation, it is recognized that the shifting soils would be quickly stabilized by incoming vegetation were it not for the great deficiency in plant nutriments, particularly nitrogen in the ash. If the plants that start were able to grow thriftily the entire valley would be quickly covered with a luxuriant vegetation. The available supply of nitrogen in the soil must be gradually built up through the growth and decay of incoming vegetation. It appears from this paper that a long time must intervene before Katmai Valley will again bear a woody vegetation comparable to the one destroyed by the great eruption of 1914.

J. W. T.

Griggs, Robert R.: IX. The Beginnings of Revegetation in Katmai Valley. *The Ohio Journal of Science*, Vol XIX, No. 6, pp. 318-342.

Report of the Judges on the Plantations Competition

The comprehensive report of Messrs. Bennett and Long on the plantation competition in certain counties in Great Britain, held in connection with the Royal Agricultural Society's Show at Cardiff,, England, 1919, is worthy the attention of American foresters due to the number of American species reported upon and the many points brought out relating to timber production

by planting, a number of which might be at least suggestive to American planters.

It is noted that repair planting and cleaning operations have been neglected during the period of the war, but that steps are now being taken to overtake arrears in this respect. It is also interesting to note that the abnormal demand of recent years for practically all classes of wood products and high prices have made possible the clearing of many poor class woods which under the ordinary course of affairs would have given little opportunity for a profitable market. It is interesting to note that this same situation has existed in New England, where, due to the scarcity and high prices for coal, inferior and irregular stands of poor hardwoods have been cut at a profit for fuel wood, thus making possible in parts of New England as well as in England the establishment of new fully stocked stands in place of the inferior old ones, either by natural or artificial regeneration.

The number of entries in the competition for last year was 24, confined to four English counties. Competition was planned for seven classes of timber. There were, however, no entries in classes 1 and 2, the hardwood sections. There were six entries in class 3 for plantations of conifers which have been weeded or slightly thinned, including the removal of dead or dying trees, and of not less than ten years' growth. There were four entries for class 5, namely, the best examples showing systematic management of an existing hardwood area, including the renovation and conversion of unprofitable wood into a profitable condition. There were seven entries in class 6, namely, plantations not less than two acres of any of the rarer conifers, pure or mixed, not less than five nor more than thirty years old. There were four entries for class 7, namely, the best managed woodland estate not less than a thousand acres in extent, the judges to take into account the production of timber, ornamental planting, planting for sporting purposes and the improvement of residential amenities and the proper management of hedgerow timber.

The striking feature brought out in the judges' report on all of these plantations is the present excellent condition and rapid growth of both Douglas fir and Sitka spruce in most of the plantations. In most cases, these species had far outgrown the indigenous trees, and although none had as yet reached economic maturity they are now for the most part in excellent conditon and making rapid growth. It is not possible in this review to discuss all of the plantations under the five different heads for which entries were made. A few illustrations must suffice.

One of the prize plantations in class 3 is owned by the Birmingham Corporation. It has an area of 79 acres and consists almost entirely of European larch, with Scotch pine on the higher elevations, one and two year seedlings were used in planting. They were set 14 years ago at a spacing of four feet by notching. The cost of planting and upkeep for the first two years was £4 1s. 2d. per acre, or approximately $20. The stand, although on rather poor, thin soil, on slopes varying from steep to very steep, is in excellent condition and growing well. It is noted that a small experimental block of Japanese larch have made more rapid growth than the native species. The best trees have attained a height of 22 feet and a breast height diameter of 5 inches; the crop has closed, the surface vegetation has disappeared, and the present annual height growth is two feet or more. On the other hand, the best of the native larch has attained a height of 18 feet and a diameter of 4 inches. The canopy is not as yet complete. About one tree in four is tending to become dominant at the expense of the others. The Japanese species appears to be freer from disease than the native larch.

It is noted that the same corporation has flourishing young plantations of Douglas fir and Sitka spruce as well as of Scotch pine and Corsican pine. The Douglas fir was in particular making splendid growth on sheltered rocky slopes.

One of the better plantations described under class 4 consisted of 40 acres of pure European larch, 35 years of age, situated on a very steep slope, facing west to northwest, with a very thin, light, loamy soil. This area was previously covered with scrub hardwood of little value, and the present stand is cited as a splendid example of the possibilities of converting hundreds of acres of similar scrub into valuable coniferous stands. The present crop on the better part of the plantation consists of 520 trees to the acre, having a volume of 3,600 cubic feet of wood. On the higher, more exposed areas the yield is much less. This plantation was given the gold medal of the society, not because of the high yield, but because it was considered the best example of silvicultural management.

The best example under class 5, showing silvicultural management of existing woodland, was an area of from 200 to 300 acres on a gravelly soil of overlying sandstone and coal measures. The former unprofitable crop was oak copice with thinly scattered larch and pine standards. Ten years ago the management undertook its systematic conversion into conifers. At that time 70 acres of the area was clear cut and planted with Douglas fir, black spruce, and European larch,

with about 10 per cent of beech in mixture. Two-year-old seedlings were planted by notching at from 3½ to 4 foot intervals. The cost was £6 per acre. Replanting failed places cost 10s. per acre. Since then other areas have been converted into coniferous stands wherein Douglas fir, Sitka spruce, Japanese larch, and Corsican pine have been used in considerable quantities.

The object of the above competition is to encourage good forestry. It shows the intense interest Great Britain is now taking in forestry and the realization of the need for growing first-class crops of timber rather than the indifferent stands so prevalent in pre-war times.

J. W. T.

Bennett, W. H., and Long, A. P.: Report on Plantations Competition, *Quarterly Journal of Forestry*, Vol. XIII, pp. 221-253, October, 1919.

NOTES

Red Pine Attacked by the White Pine Weevil

In July, 1918, in a plantation of mixed white pine (*Pinus strobus* L.), red pine (*Pinus resinosa* Ait.), and Scotch pine (*P. sylvestris* L.), but consisting mainly of red pine, on the South Mountain Reservation, near Orange, N. J., the white pine weevil (*Pissodes strobi* Peck), was observed infesting young shoots of the red pines. The trees of all three species, several thousand in number, and covering several acres, were about eight years old and varied from five to eight feet in height. Numerous white pines were also infested, and where these trees adjoined the red pines, the latter were most severely affected. However, only comparatively few red pines were affected, 24 being counted. Specimens of the injured red pine were sent to Dr. A. D. Hopkins, of the U. S. Department of Agriculture, who confirmed the writer's identification. The Scotch pines were uninjured.

The case is noteworthy since it is the first specific record, so far as the writer can ascertain, of infestation of the red pine by the white pine weevil. The red or Norway pine has long been regarded as entirely free from this pest, and on this account, as well as its freedom from the dreaded blister rust and its comparatively rapid growth, is being looked upon with increasing favor by planters in the Eastern States.

It is not to be inferred from the above that the tree is likely to become generally infested, and yet it is a matter of considerable importance to know that under certain conditions, perhaps mainly the immediate proximity of badly infested white pines, it may become attacked. Sporadic attacks on the Scotch pine, under similar circumstances, have also been noticed by the writer near New Haven, Conn. Dr. Hopkins records the species on "native and cultivated spruces, the jack pine and very rarely the pitch pine and other eastern pines."[1]

[1]Hopkins, A. D. The White Pine Weevil, U. S. Dept. of Agri., Bur. of Entomology Cir. 90. p. 3. 1907.

Arthur H. Graves.

Notes on Nursery Stock of White Pine

On May 28, 1915, a limited test of the effect of puddling white pine nursery stock was made at the Harvard Forest School, Petersham, Mass., by the writers. The resulting data, while too scanty to be conclusive on the widely discussed question of puddling, point to the conclusion that the gain, if any, is too slight to be worth the trouble. The test also demonstrated the surprising ability of white pine seedlings to withstand abuse, as previously pointed out by Ziegler.[1]

Conditions.—A clear day, with frost at sunrise, and a maximum temperature of 51° F. about 3 p. m. Very high northwest winds, giving a wind movement of 209 miles between 8 a. m. and 8 p. m. at the nearest Weather Bureau station at Amherst, Mass., about 30 miles distant. Mean relative humidity at Amherst, 44.5. Place of exposures, in full sunlight, sheltered from the full force of the wind, but exposed enough to make it necessary to weight the exposed seedlings with small rocks. Exposures were made on an old door placed horizontally on the ground.

Stock.—White pine (*P. strobus*) two year seedlings, grown in a rather dense stand of about 8,000 per bed of 48 square feet. Source of seed, Michigan. In an effort to make the trees tender, they were dug and heeled in, without puddling, four weeks previous to the date of the test. Growth had started while the trees were heeled in. Average length of new growth, 1½ inches. The trees for this test were carefully graded to secure uniformity of size, vigor, new growth, and root systems.

Exposures.—The trees were exposed in lots of 20, half puddled and half not puddled, and were left in the full sunlight and wind for the periods indicated in the table. The puddle was rather thin, but coated the rootlets completely. At the end of the period of exposure, the trees were root pruned rather severely, and at once placed in transplant rows in fresh, soft earth, ideal for transplanting. The roots of the puddled trees were separated if they had been matted by the puddle.

Record of Results.—The following table shows the survival at the end of one week and of two weeks. The test was then abandoned as other factors, including loss from white grubs, made further results uncertain.

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[1]For. Quart. 12, p. 31, and 13, p. 163.

Exposure		Results in one week						Results in two weeks					
		Trees puddled			Trees not puddled			Trees puddled			Trees not puddled		
Period	Beginning A. M.	Thrifty	Leader wilted	Dead	Thrifty	Leader wilted	Dead	Thrifty	Leader wilted	Dead	Thrifty	Leader wilted	Dead
0 hr. 0 m.	10.30	10	0	0	10	0	0	10	0	0	10	0	0
0 hr. 10 m.	10.35	10	0	0	10	0	0	10	0	0	10	0	0
0 hr. 20 m.	10.45	10	0	0	9	1	0	10	0	0	9	1	0
0 hr. 30 m.	10.50	10	0	0	6	4	0	10	0	0	6	4	0
0 hr. 40 m:	10.55	9	1	0	1	9	0	10	0	0	2	8	0
0 hr. 50 m.	11.00	8	2	0	2	8	0	8	2	0	3	7	0
1 hr. 0 m.	11.00	5	4	1	1	9	0	5	4	1	1	9	0
1 hr. 20 m.	12 m.	2	8	0	0	8	2	2	8	0	0	7	3
1 hr. 40 m.	11.50	5	5	0	6	4	0	4	6	0	6	4	0
2 hr. 0 m.	11.12	0	8	2	0	5	5	0	8	2	0	5	5
2 hr. 30 m.	11.45	0	6	4	0	5	5	0	6	4	0	2	8
3 hr. 0 m.	11.17	1	7	2	0	6	4	1	7	2	0	6	4
4 hr. 0 m.	11.25	0	4	6	0	3	7	0	1	9	0	2	8
5 hr. 0 m.	11.20	1	2	7	0	0	10	1	1	8	0	0	10

E. E. CARTER AND L. R. GROSE.

BLISTER RUST CONFERENCE AT ST. PAUL

A blister rust conference relating to the disease in Minnesota and Wisconsin was held at the University Farm, St. Paul, October 6, 1919. The Office of Blister Rust Control was represented by Dr. P. Spaulding and S. B. Detwiler; the Forest Service by A. F. Hawes and C. J. Stahl; the State Forest Service of Minnesota by D. P. Tierney; and the Forestry Department of the University of Minnesota by E. G. Cheyney and other members of the staff. Offiials in charge of disease control in both Minnesota and Wisconsin were also present.

A program was adopted by the conference which is based upon the consensus of opinion of those present that the disease is now so widespread that the time for attempting general and complete eradication has passed, and the future policy of control must be that of local control. Several recommendations were made relative to nursery inspection, patholigical and forest management investigations, an educational campaign, and legislation. The most concrete recommendation was that relating to the National and State Forests in Minnesota, which is here quoted. The conference made the following recommendations to

the organizations controlling the public lands, such as the United States Forest Service and the State Forest Service, etc.:

A. Nurseries such as the Cass Lake nursery, the Cloquet nursery, and other nurseries of a similar nature should be immediately protected by the eradication of Ribes within 1,700 feet or one-third of a mile. Mr. Pierce has already brought this to the attention of the forest supervisor at Cass Lake and the district forester's office at Denver.

B. It is recommended that an intensive study of National Forests and State Forests, etc., in Minnesota be made to determine:

(a) The relation of Ribes and white pine, including the species and number of Ribes and their habitats.

(b) On what areas it will be feasible to eradicate Ribes; what areas have few, if any, Ribes; the possibility of growing white pines on these areas.

(c) The location of areas of young native white pine or white pine plantations would seem to first demand protection from the blister rust.

C. White pine should be planted only where Ribes are absent or where it is possible to protect the pine from the blister rust by the eradication of Ribes. From the work in Minnesota (Cheyney) it seems quite certain that Ribes eradication in some swamps is impracticable and impossible. Any planting of white pine close to swamps is, therefore, inadvisable.

D. It is further recommended that an early beginning be made on Ribes eradication in each forest where white pine grows and that there be established a permanent policy in each forest for continuing such eradication.

The Empire State Forest Products Association, while mainly formed in the private interests of its members, under the active efforts of its secretary and forester, Prof. A. B. Recknagel, fulfils a public function by keeping tab on all forest legislation in the State and publishing its status in bulletins. From Bulletin No. 2 we learn that "the legislature of 1919 accomplished little or nothing in the way of constructive legislation affecting our forests and waters," some fifteen measures at least being reported dead or vetoed.

In the same bulletin the directors are reported to have formulated five fundamental points of policy in any national program of forestry, namely:

(1) Any law to control the methods of cutting timber on private lands, invades the constitutional property rights of timberland owners.

(2) Any plan modifying present methods of logging so as to secure continuous forest production must result from co-operation and agreement between the government and the private owner and must provide an adequate incentive for private forestry practice.

(3) A national program of forestry to be equitable and effective must extend to all competitive sources of supply, including Canada as well as the United States.

(4) A national program of forestry must be extended to include the public timberlands, State and National, as well as those in private ownership.

(5) A national program of forestry must consider competing substitutes for wood, as well as forest products themselves, in fixing prices. Otherwise, it puts a premium on the use of substitutes.

Some time ago an experienced German forester expressed himself on artificial vs. natural regeneration as follows: "Fortunately there was a time when it was supposed to be the best method to clear the old conifer and oak stands and replace them by hand. From this time date the dense 20-30-40-50 (now up to 80) year spruce-pine-oak polewoods which luckily today can be shown with pride in many districts. They are the true stands of the future which will furnish much more valuable material than our old stands (the result of natural regeneration and planting). Clearing deserves, with a few exceptions, preference over natural regeneration, but should be done in small strips so as to secure side shade."

The Commissioners of the Land Office of the State of New York have lately added to the Adirondack Forest Preserve what is stated to be one of the largest purchases, namely, the Santa Clara Lumber Co.'s tract of 18,000 acres in Township 27, Franklin County. This tract, adjoining the Axton property, includes the whole of Mt. Seward and Mt. Seymour and the beautiful Ampersand Pond. The price paid was about $26 per acre (compared with $6.50 for the Axton tract in 1899), with the reservation, however, of the right of the lumber company to remove 100,000 standards of softwood before 1925. Another purchase of 12,000 acres approaching north slope of Mt. Marcy was also sanctioned.

According to the best available records the following foresters have received war decorations: Lt. Col. R. E. Benedict, Chev. L. d'H.; Lt. Col. W. B. Greeley, Chev. L. d'H., D. S. O.; Maj. B. Moore, Chev. L. d'H.; Lt. Col. A. S. Peck, D. S. M.; Lt. Col. T. S. Woolsey, Jr., Chev. L. d'H., D. S. O., Chev. Ordre Leopold.

If other foresters have received decorations they should report the fact to the Society.

As a result of an investigation of mill and woods waste in western Washington, Professor Kirkland finds that only 37 per cent of the cubic volume of the wood brought to the mill reappears as lumber, and that there is little question that 50 per cent of the volume of the standing tree is left in the woods, so that the total utilization in the form of lumber figures out only 18.5 per cent. The importance of using this enormous waste of around 80 per cent as fuel, pulpwood and for minor uses of various kinds is pointed out.—*University of Washington Forest Club Annual, 1909.*

The *Yale Forest School News* for July brings a very interesting account of the activities of the Forest Products Laboratory at Madison during the war, which shows how important the once despised "timberphysics" work of the old Forestry Division has grown to be. The growth in the number of the personnel alone is impressive, the force having grown from 80 before the war to 450 at the end, and is still over four times the number in past peace times.

Seventy-five per cent of the work had reference to aircraft construction. Tieman's water spray kilns answered the requirement of rapid seasoning without injury; the suitability of some 130 species, native and foreign, for aircraft construction was ascertained by some 300,000 tests; a waterproof finish was evolved (aluminum leaf); a waterproof glue for use in construction of plywood was developed, and the suitability of various species for plywood was ascertained and, in connection with these inventions, promises to change the use of wood in built-up material and laminated articles, such as walnut gunstocks. A separate box-testing laboratory was set up to test various forms of containers for the Ordnance Department. Wood pulps as substitutes for cotton linters were successful, and charcoal for absorption of poisons in gasmasks. As a means of conserving foods, a greater production of ethyl alcohol from wood waste was secured by over 50 per cent; also that of acetic acid from sawdust. Besides these a host of minor investigations were carried on.

The Portland, Oregon, local section held its first open meeting of the winter season on Hallowe'en night, but instead of bobbing for apples it listened to a most interesting discussion by Colonel W. B. Greeley on "A Working Plan for a French State Forest." Besides giving a clear sketch of the essentials of a typical French working plan, Colonel

Greeley made an interesting analysis of the points of difference between the French and the German methods and pointed out the lessons that we could learn from each. He also described the French system for regulating private forests, which drew forth many questions from Mr. Geo. Cornwall, Mr. Cecil, Mr. Andrews, Mr. Nelson and others of the twenty who were present. The meeting was held at the home of Mr. Thornton T. Munger.

On October 24 a committee of the National Lumber Manufacturers' Association, previously appointed to consider the question of a "National Forest Policy," met in Chicago. The following resolution was presented by the committee and adopted:

Referring especially to the suggestions for a national forestry policy as presented today by the Chief Forester of the United States, Col. H. S. Graves, and in response to the request of the National Lumber Manufacturers' Association, we recognize that both national and industrial welfare demand early development of an American forest policy which shall substitute for indifference or accident an intelligent, practical, equitable and concerted program for the perpetuation of forest supplies; and in behalf of the National Lumber Manufacturers' Association we offer the facilities of the lumber industry to the end that the determination of such program may be effective and consistent with the true interests of the republic.

Following the adoption of the resolution, discussion of what could be done by the lumber industry to aid in formulating a "National Forest Policy" was taken up. As a result of this discussion the following resolution, presented by E. T. Allen, was adopted:

Recognizing that no general regulations can be properly imposed and that most forestry problems are largely local, we recommend that each constituent organization of the National appoint a committee to consider the valuable suggestions made by Col. Graves, to confer with their local, State and Federal forestry authorities as to what steps are needful and practical in their respective territories and to promote the adoption by the public and by industry of such program as may be mutually agreed upon.

We further recommend the continuance of a standing committee representing the National Association; preferably one also representative of the local committees mentioned, which shall assist the said locals and the Government in all related matters requiring general consideration.

The following resolution was unanimously adopted by the Western Forestry and Conservation Association:

Referring specifically to the suggestions for a national forest policy forwarded us for discussion by Chief Forester Graves, and concerning which we are also requested by the National Lumber Manufacturers' Association to re-

port our conclusions, we endorse Colonel Graves' proposed program as the most constructive and statesmanlike treatment of the subject we have seen and urge lumbermen and foresters alike to accept it, in the same temperate spirit he has shown, as a basis for discussing future co-operation.

As an earnest of our own approval, we hereby request our chairman to appoint a permanent committee to co-operate with State and Federal forest authorities in working out the problems and legislation suggested.

In accordance with action taken at the meetings a committee, with E. T. Allen as chairman, was appointed by President Flewelling to work with Federal and State authorities in carrying forward a national forest policy.

NEW ZEALAND.

A Chief Inspector of Forestry is required by the New Zealand Government. Salary £600 per annum increasing to £700. Candidates should be graduates of a School of Forestry of recognized standing. Full particulars and forms of application obtainable from the High Commissioner for New Zealand, 415 Strand, London, by whom complete applications will be received up to the 20th of January, 1920.

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